

# **BASIC ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE MERGING OF THE MAMATWAN SINTERFONTEIN WRD AND TSHIPI EASTERN WRD**

**SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL  
MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN  
RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL  
AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002, AS AMENDED**

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## EXECUTIVE SUMMARY

### PROJECT BACKGROUND

South32 operates the opencast manganese Mamatwan Mine (MMT) (forms part of the legal entity Hotazel Manganese Mines (Pty) Ltd) located approximately 25km to the south of Hotazel in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province of South Africa. MMT holds the following environmental permits and authorisations (included in Appendix A):

- A Mining right (Reference number: NC 256 MR) issued and approved by the former Department of Minerals and Energy (DME) (currently the Department of Mineral Resources (DMR)) in May 2006.
- An Environmental Management Programme (EMP) (Reference number: NC 6/2/2/118) issued and approved by the former DME (currently the DMR) in November 2005.
- An Air Emissions Licence (AEL) (Licence number: NC/AEL/NDM/ZRH01/2014) issued by the Northern Cape Department of Environment and Nature Conservation (DENC) in March 2015.
- An amended Integrated Water Use Licence (IWUL) (License number: 10/D41K/KAGJ/1537) issued by the Department of Water and Sanitation (DWS) in January 2012.
- A Waste Permit (Permit number: B33/2/441/21/P157) for the development and operation of a decommissioned general waste disposal site issued by the former Department of Water Affairs and Forestry (currently DWS) in February 1995.
- An Environmental Authorisation (Reference number: NC/KGA/HOT3/07) for bulk fuel storage issued by former Department of Tourism, Environment and Conservation (currently DENC) in July 2007.

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) operates the Tshipi Borwa Mine located on the farms Mamatwan 331 and Moab 700, located to the west of MMT. An 18m wide (on surface) boundary is located between the MMT and the Tshipi Borwa Mine. Tshipi and MMT have approval to mine the 18m wide boundary pillar. Additional capacity is required to store waste rock generated as part of mining the boundary pillar. To cater for the additional storage, it is proposed that the Mamatwan Sinterfontein and the Tshipi eastern Waste Rock Dump (WRD's) are merged to fill the void between the two dumps (Figure 2). In this regard, the Mamatwan Sinterfontein WRD would be extended in a north-westerly direction to merge with the Tshipi eastern WRD in order to fill the narrow void between these two WRDs.

MMT is proposing on amending their approved EMP to cater for the merging of the WRDs (referred to as the WRD extension).

### SUMMARY OF AUTHORISATION REQUIREMENTS

Prior to the commencement of the proposed project, the following is required:

- An approved amended EMP from the DMR in terms of Section 102 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)
- An environmental authorisation from the DMR in terms of the NEMA, as amended. The Environmental Impact Assessment (EIA) Regulations being followed are Government Notice Regulation (GNR) 982 of 4 December 2014, as amended. The relevant listed activities are included in Section 3.1.

- A Waste Management Licence from the DMR in terms of the National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA). The relevant listed activity is included in Section 3.1.

In addition to the above list, an amendment of the IWUL from the DWS in terms of Section 21 of the National Water Act (No. 36 of 1998) is also required. In this regard, a separate application will be submitted to the DWS for consideration. For completeness purposes, the relevant listed activity to be applied for as part of the IWUL amendment process is included in Section 3.1 of this report. The Regulations being followed to amend the IWUL are the GNR 267 of 2017 for the Procedural Requirements for Water Use Licence Applications.

## STAKEHOLDER ENGAGEMENT

The stakeholder engagement process commenced prior to the submission of the BAR (Basic Assessment Report) 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 a public meeting, submit questions and comments to the project team, and review the background information document and now the BAR. All comments submitted to date by the commenting authorities and IAPs have been included and addressed in this BAR. Further comments arising during the review of the BAR report will be handled in a similar manner.

This BAR will be distributed for a 30 day comment period from **25 April 2019 to 31 May 2019** in order to provide I&APs with an opportunity to comment on any aspect of the proposed project and the findings of the BA process. Copies of the full report will be made available on the SLR website (at <https://slrconsulting.com/za/slr-documents/>) and at the Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Hotazel Public Library and Kathu Public Library, Black Rock Library. Electronic copies (compact disk) of the report are available from SLR, at the contact details provided below.

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## 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/or 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. All identified impacts are considered both incrementally and cumulatively in the context of the existing MMT 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	
			Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	Mineral resources can become sterilised through the placement of surface infrastructure and waste. The proposed WRD extension could present the potential for sterilisation of mineral resources. The WRD extension is located centrally between the existing Tshipi and Mamatwan mining operations. No sterilisation of mineral resources is expected. No management actions are deemed necessary.	Insignificant	Insignificant
Topography	Altering topography	The natural topography at the MMT has been disturbed as a result of the existing mining infrastructure and activities. The establishment of the proposed WRD extension will further alter natural topography and cannot be mitigated. It is however important to note that the WRD extension is located centrally between the existing Tshipi and Mamatwan mining operations. Any potential alteration of topography is expected to be negligible. Related management actions include minimising the area of disturbance and rehabilitation in accordance with approved mine closure plan.	Insignificant	Insignificant
Soil and land capability	Loss of soil resources and land capability through contamination and physical disturbance	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 WRD extension will occupy a relatively small area of 4 ha, located centrally between the existing Tshipi and Mamatwan mining operations. The soil resources in the proposed WRD extension footprint has already been influenced by anthropogenic activities (witbank soil forms) to the extent that the land use options as well as performance of the soil to support vegetation has been affected. Related management actions focus on pollution prevention, implementing soil conservation procedures and limiting site clearance to what is absolutely necessary.	Insignificant	Insignificant
Biodiversity	Physical destruction and general disturbance of biodiversity	The development of the proposed WRD extension has the potential to destroy or disturb biodiversity in the broadest sense, particularly in the unmitigated scenario. This will present a final land form that may have pollution potential through long term seepage and/or runoff. Areas of ecological sensitivity include functioning biodiversity areas with species diversity (including protected species) and associated intrinsic value. Linkages between these 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	Medium	Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		for the broader ecosystem. The transformation of land for any purpose 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. It should however be noted that the proposed WRD extension is located centrally, adjacent to and within existing MMT and Tshipi Borwa Mine mining activities which has influenced the condition of naturally occurring vegetation. No protected species were noted in the area where the WRD extension is proposed. The proposed footprint is located within an area rated by the biodiversity specialist to have moderate-low sensitivity. Related mangement measures focus on limiting the project footprint area and operation controls to limit on-going disturbance.		
Surface water	Alteration of natural drainage patterns	Natural drainage across the project area is via sheet flow. Drainage patterns have been altered by existing approved mining activities. The extension of the WRD will require an adaptation of existing stormwater management measures in order to contain dirty water in compliance with R704 of the NWA. Stormwater management measures will be in place until such time as the WRD extension is rehabilitated. The WRD extension will occupy a relatively small area of 4 ha, located centrally between the existing Tshipi and Mamatwan mining operations. Any potential loss of runoff to the catchment is expected to be negligible. Related management actions focus on diverting clean run-off away from the site.	Insignificant	Insignificant
	Contamination of surface water resources	The proposed WRD extension presents a potential long-term contamination source to surface water through seepage reaching the baseflow of rivers and runoff from the side slopes of the WRD reaching the nearest drainage lines. However, given that the WRD extension is located centrally between the existing Tshipi and Mamatwan mining operations, the nearest drainage lines to the WRD extension are between 3 km (the ephemeral Vlermuisleegte River) and 6 km (the ephemeral Witleegte River) away, and the WRD extension will be designed with stormwater management measures that comply with R704 of the NWA, it is considered highlight unlikely that any potential seepage or runoff from the WRD extension would reach drainage lines in the vicinity of the mine. Related mitigation measures focus on pollution prevention and monitoring.	Insignificant	Insignificant

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
Groundwater	Contamination of groundwater resources	The proposed WRD extension presents a potential long-term contamination source to groundwater and is expected to be a permanent structure at the mine. Modelling results indicate that a plume of low contamination would extend outside of the Mamatwan Mining Right area into the Tshipi Mining Right area. No third party boreholes fall within the predicted contamination plume. Related management actions focus on monitoring, pollution prevention through basic infrastructure design.	Low	Low
Air quality	Air pollution	The extension of the WRD presents a number of sources that can have a negative impact on ambient air quality and surrounding land uses in all phases. Sources include clearing of vegetation, materials handling, wind erosion from stockpiles and wind erosion of disturbed areas. These activities already take place on site as the mine is in operation; however, the establishment and operation of the proposed WRD extension would contribute additional dust generation sources. The advantage of the WRD from an air quality perspective is that the footprint is small (approximately 4 ha), and that it is shielded by the existing Tshipi Eastern WRD to the west and the existing Mamatwan WRD to the east. The Tshipi Eastern WRD should act as a wind barrier from the stronger westerly winds, and to some extent from the northerly winds. The filling of waste rock into the void instead of tipping at the crest of the WRD, would also reduce potential impacts. Related management actions focus on pollution prevention and monitoring.	Low	Low
Noise	Increase in disturbing noise levels	Although the development and disposal of waste rock as part of the proposed project is associated with noise generating activities, the increase in noise levels at potential receptor sites is expected to be negligible. This is based on the results of the background noise sampling (which was undertaken at a time when mining operations were active) which indicated that the area has noise levels typical of a rural area as well as the location of the proposed project area centrally between the current Tshipi and MMT mining activities. This is further influenced by the short-term duration of the activities (less than the life of mine) and the distance of between 3 and 6 km between the WRD extension area and potential noise receptors. Related management actions focus on noise pollution prevention and monitoring when required.	Insignificant	Insignificant
Visual	Negative visual views	The visual landscape within the MMT area has been transformed due to the presence of approved mining infrastructure and activities. The proposed WRD extension area is located centrally between the current Tshipi Borwa Mine and the MMT mining	Insignificant	Insignificant



Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		activities and is therefore not expected to influence existing negative visual impacts. The WRD extension would be absorbed into current views of the mining activities. At closure the WRD extension would be rehabilitated in line with the mine's rehabilitation and closure plan which makes provision for a final land use of wilderness. Related management actions focus on rehabilitation.		
Traffic	Road disturbance and traffic safety	The proposed WRD extension will not generate additional traffic and as such project-related road disturbance and traffic safety impacts are not expected to occur. This issue is therefore not assessed further in this EIA. The significance of impacts associated with the overall MMT would remain unchanged. No management actions are deemed necessary.	Not applicable	Not applicable
Heritage/cultural and palaeontological resources	Loss of heritage/cultural and Palaeontological resources	No heritage resources occur within the area proposed for the WRD extension. In addition, there is a low possibility of palaeontological resources occurring in the area. Related management measures include notifying heritage and/or palaeontological specialists in the event of a chance find.	Insignificant	Insignificant
Socio-economic	Inward migration and economic impact	Given that the project forms part of existing approved operations and that the proposed extension to the WRD will not generate any additional employment opportunities, negative project-related socio-economic impacts including inward migration are not expected to occur. In addition, the extension of the WRD is required to provide additional capacity to store waste rock that is generated as part of mining the boundary pillar. The economic benefits associated with mining the boundary pillar have previously been accounted for. As a result the potential for increased economic benefits due to project activities is expected to be negligible. This issue is therefore not assessed further in this BAR. Management actions are not deemed necessary.	Not applicable	Not applicable
Land use	Change in land use	Mining-related 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 proposed WRD extension will be established within the existing mining area and will not change the current land use. Related management actions include communication with neighbouring communities and rehabilitation for post closure land use.	Low	Low

## ENVIRONMENTAL STATEMENT

The assessment of the proposed project presents the potential for negative impacts to occur (in the unmitigated scenario in particular) on the biophysical, 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 EMPr is effectively implemented there is no biophysical, social or economic reason why the project should not proceed.

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## ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
ABA	Acid base accounting
AEL	Air Emissions Licence
As	Arsenic
BA	Basic Assessment
BAR	Basic Assessment Report
B	Boron
BID	Background Information Document
Ca	Calcium
CBA	Critical Biodiversity Area
CH <sub>4</sub>	methane
Cl	Chloride
CI	Conservation Important
CO	carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CO <sub>3</sub>	Carbonate
COC	Chemicals of concern
CV	Curriculum Vitae
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation
DME	Department of Minerals and Energy
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EMP	Environmental Management Programme
ESA	Ecological Support Area
F	Fluoride
Fe	Iron
GN	Government Notice
GNR	Government Notice Regulation
ha	Hectare
HCS	hydrocarbons
HCO <sub>3</sub>	Bicarbonate
I&AP	Interested and Affected Party
IBA	Important Bird Areas
ICP	Inter Coupled Plasma Scan
IDP	Integrated Development Framework
IWUL	Integrated Water Use Licence

Acronym / Abbreviation	Definition
K	Potassium
km	Kilometre
LMO	Lower manganese ore body
LO	Likelihood of occurrence
m	Meter
m <sup>3</sup>	Cubic metres
mamsl	Metres above mean sea level
Mg	Magnesium
mm	Millimetres
Mn	Manganese
MS	Mass Spectrometry
MMT	MMT
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002)
MMO	Middle Manganese Ore Body
Na	Sodium
N	Nitrate
NCPSPF	Northern Cape Provincial Spatial Development Framework 2012
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (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)
NPAES	National Protected Areas Expansion Strategy 2008
Na	Sodium
NO <sub>2</sub>	nitrogen dioxide
NO <sub>x</sub>	oxides of nitrogen
NWA	National Water Act, 1998 NWA, 1998 (No. 36 of 1998)
TDS	Total Dissolved Solids
RoM	Run-of-mine
RQO	Resource Quality Objectives
SACNASP	South African Council for Natural Scientific Professionals
SAPAD	South African Protected Areas Database
SAHRA	South African Heritage Resource Agency
SANS	South African National Standards
SDF	Spatial Development Framework
SLR	SLR Consulting (South Africa) (Pty) Ltd
SLP	Social and Labour Plan
SO <sub>2</sub>	Sulphur dioxide
SO <sub>4</sub>	Sulphate
SPLP	Synthetic Precipitation Leaching Procedure

Acronym / Abbreviation	Definition
Tshipi	Tshipi é Ntle Manganese Mining (Pty) Ltd
UMK	United Manganese of Kalahari (Pty) Ltd
UMO	Upper manganese ore body
VU	Vulnerable
WRD	Waste rock dump

## INTRODUCTION

This chapter provides a brief description of the project background, describes the purpose of this report, summarises the legislative authorisation requirements, provides the study terms of reference and outlines the opportunity for comment.

## PROJECT BACKGROUND

South32 operates the opencast manganese Mamatwan Mine (MMT) (forms part of the legal entity Hotazel Manganese Mines (Pty) Ltd) located approximately 25km to the south of Hotazel in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province of South Africa. The regional and local settings are illustrated in Figure 1 and Figure 2, respectively. MMT holds the following environmental permits and authorisations (included in Appendix A):

- A Mining right (Reference number: NC 256 MR) issued and approved by the former Department of Minerals and Energy (DME) (currently the Department of Mineral Resources (DMR)) in May 2006.
- An Environmental Management Programme (EMP) (Reference number: NC 6/2/2/118) issued and approved by the former DME (currently the DMR) in November 2005.
- An Air Emissions Licence (AEL) (Licence number: NC/AEL/NDM/ZRH01/2014) issued by the Northern Cape Department of Environment and Nature Conservation (DENC) in March 2015.
- An amended Integrated Water Use Licence (IWUL) (License number: 10/D41K/KAGJ/1537) issued by the Department of Water and Sanitation (DWS) in January 2012.
- A Waste Permit (Permit number: B33/2/441/21/P157) for the development and operation of a decommissioned general waste disposal site issued by the former Department of Water Affairs and Forestry (currently DWS) in February 1995.
- An Environmental Authorisation (Reference number: NC/KGA/HOT3/07) for bulk fuel storage issued by former Department of Tourism, Environment and Conservation (currently DENC) in July 2007.

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) operates the Tshipi Borwa Mine located on the farms Mamatwan 331 and Moab 700, located to the west of MMT. An 18m wide (on surface) boundary is located between the MMT and the Tshipi Borwa Mine (Figure 2). Tshipi and MMT have approval to mine the 18m wide boundary pillar. Additional capacity is required to store waste rock generated as part of mining the boundary pillar. To cater for the additional storage, it is proposed that the Mamatwan Sinterfontein and the Tshipi eastern Waste Rock Dump (WRD's) are merged to fill the void between the two dumps (Figure 2). In this regard, the Mamatwan Sinterfontein WRD would be extended in a north-westerly direction to merge with the Tshipi eastern WRD in order to fill the narrow void between these two WRDs.

MMT is proposing on amending their approved EMP to cater for the merging of the WRDs (referred to as the WRD extension).

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental assessment practitioners (EAP), has been appointed by South32 to manage the environmental authorisation processes.

## PURPOSE OF THIS REPORT

This Basic Assessment Report (BAR) has been compiled and distributed for review and comment as part of a Basic Assessment (BA) process that is being undertaken for the merging of the Mamatwan Sinterfontein WRD and the Tshipi eastern WRD.

This BAR provides a description of the proposed project and the affected environment; summarises the BA process followed to date; identifies and assesses the key project impacts and presents management and mitigation measures that are recommended to enhance positive and limit negative impacts.

Interested and Affected Parties (I&APs) are asked to comment on the BAR. The document will then be updated into a final report, giving due consideration to the comments received. The BAR will be submitted to the DMR for consideration as part of the application for Environmental Authorisation in terms of Chapter 5 of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended.

## SUMMARY OF AUTHORISATION REQUIREMENTS

Prior to the commencement of the proposed project, the following is required:

- An approved amended EMP from the DMR in terms of Section 102 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)
- An environmental authorisation from the DMR in terms of the NEMA, as amended. The Environmental Impact Assessment (EIA) Regulations being followed are Government Notice Regulation (GNR) 982 of 4 December 2014, as amended. The relevant listed activities are included in Section 3.1.
- A Waste Management Licence from the DMR in terms of the National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA). The relevant listed activity is included in Section 3.1.

In addition to the above list, an amendment of the IWUL from the DWS in terms of Section 21 of the National Water Act (No. 36 of 1998) is also required. In this regard, a separate application will be submitted to the DWS for consideration. For completeness purposes, the relevant listed activity to be applied for as part of the IWUL amendment process is included in Section 3.1 of this report. The Regulations being followed to amend the IWUL are the GNR 267 of 2017 for the Procedural Requirements for Water Use Licence Applications.

## TERMS OF REFERENCE

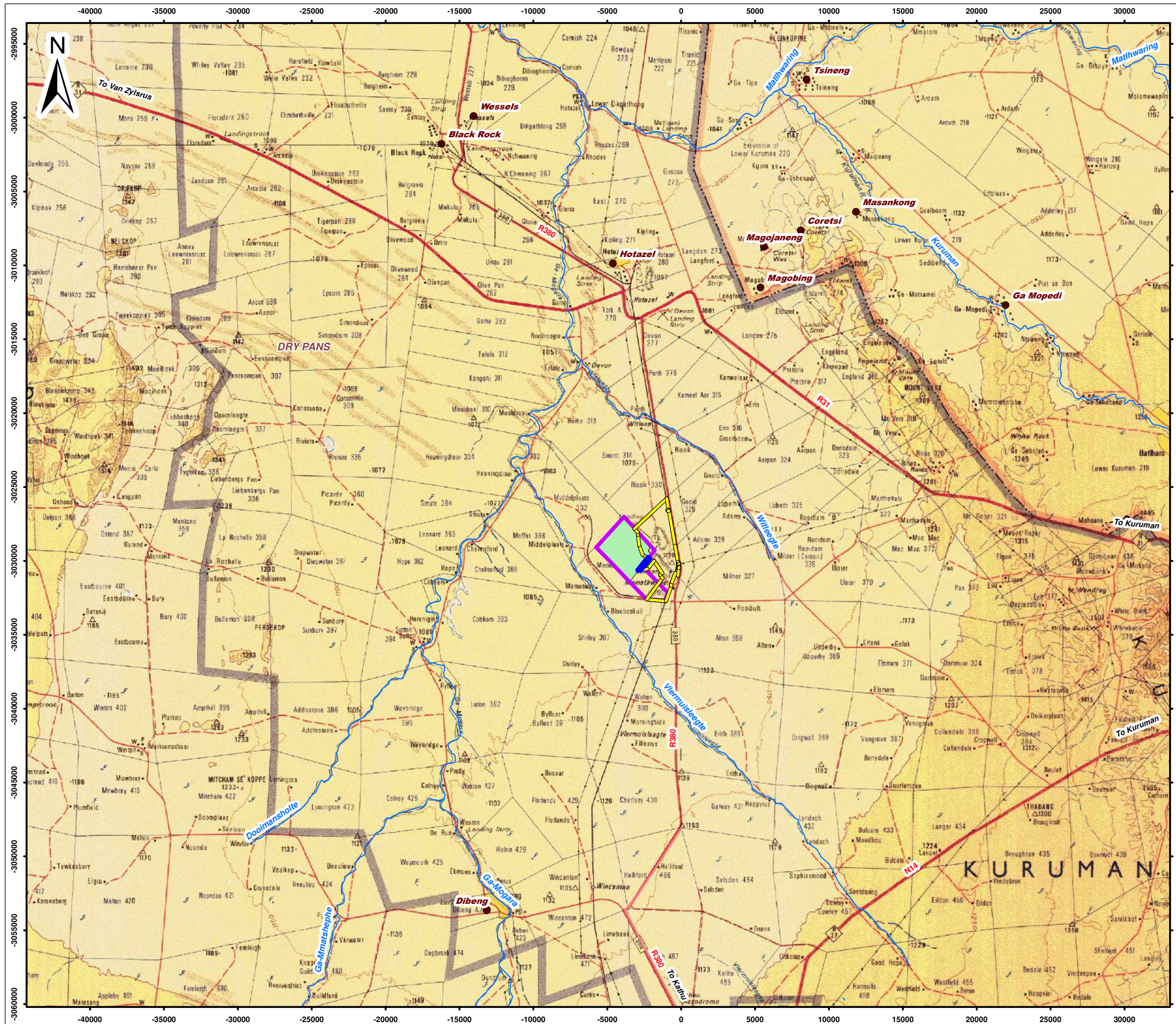
SLR, as the independent EAP, is responsible for undertaking the required environmental regulatory process and conducting the public participation process. The terms of reference for the environmental regulatory process are to:

- Make application for Environmental Authorisation of the proposed project in terms of NEMA, NEM:WA, NWA and the MPRDA
- Ensure the BA process is undertaken in accordance with the requirements of NEMA, EIA Regulations 2014, MPRDA, NEM:WA and NWA.
- Ensure the BA is undertaken in an open, participatory manner to ensure that all potential impacts are identified.

- Undertake a formal public participation process, which includes the distribution of information to interested and affected parties (I&APs) and provides the opportunity for I&APs to raise any concerns/issues, as well as an opportunity to comment on all BA documentation.
- Integrate all the information, including the findings of the specialist studies and other relevant information, into a BA Report (BAR) to allow an informed decision to be taken on the proposed project.

Further to this and in accordance with Appendix 1 of the EIA Regulations 2014 (as amended) and the DMR reporting requirements, the key objectives of this BA process are to:

- Determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context.
- Identify the alternatives considered, including the activity, location, and technology alternative.
- Describe the need and desirability of the proposed alternatives.
- Through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within the sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine:
  - The nature, significance, consequence, extent, duration, and probability of the impacts occurring.
  - The degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed or mitigated.
- Through the ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to:
  - Identify and motivate a preferred site, activity and technology alternative.
  - Identify suitable measures to avoid, manage or mitigate identified impacts.
  - Identify residual risks that need to be managed and monitored.



**Legend**

- Mamatwan Mining Right Boundary
- Sinterfontein Waste Rock Dump Void
- Tshipi Surface Use Area
- Tshipi Mining Right Area
- Towns / Villages
- Main Roads
- Rivers

0 4 8 Kilometers

Scale: 1:250 000 @ A3

Projection: Transverse Mercator  
Datum: Hartbeeshoek, Lo 23

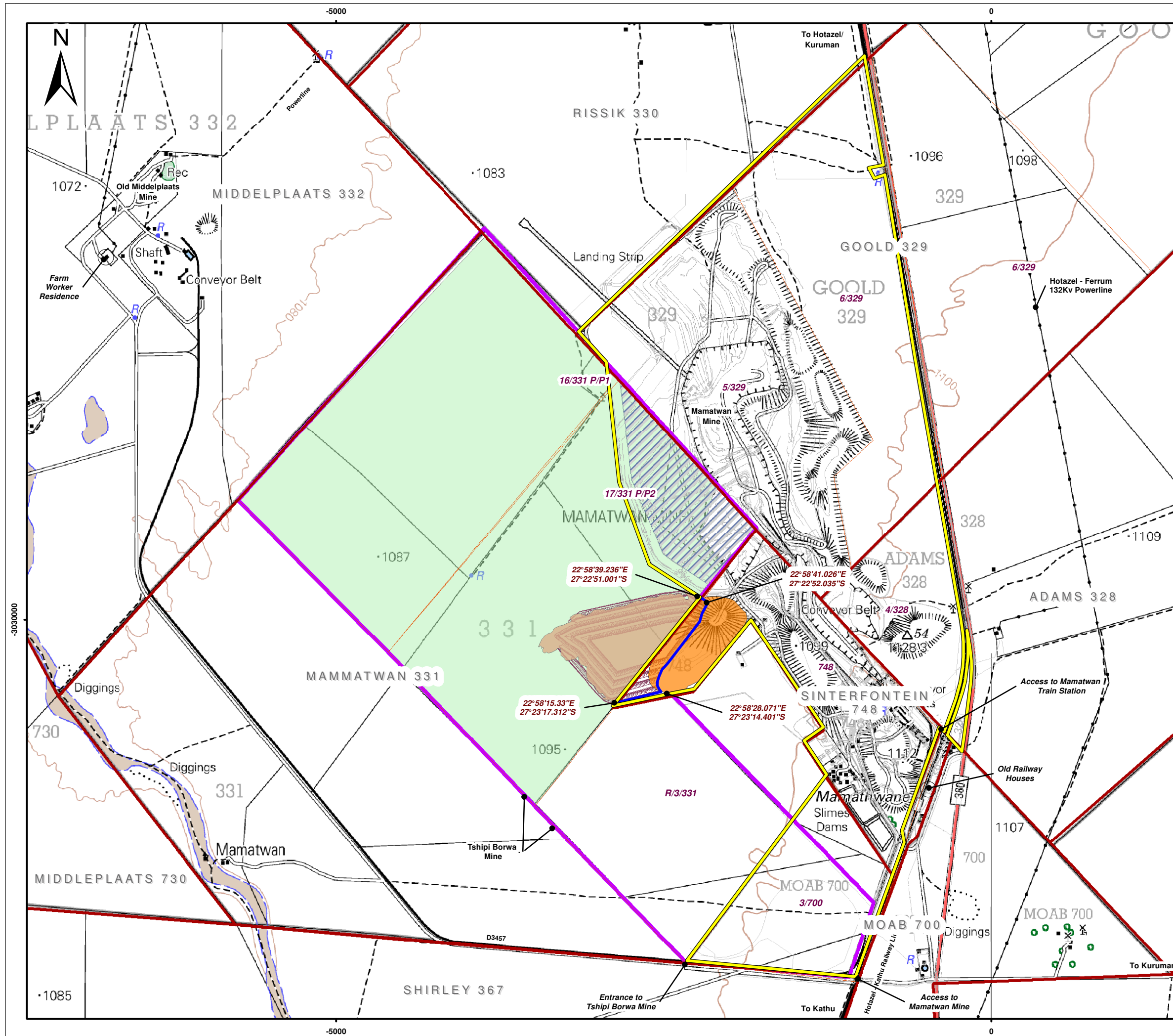
Mamatwan Mine

**Figure 1**  
Regional Setting

**SLR**

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**Legend**


- Final Merged Waste Rock Dump
- Sinterfontein Waste Rock Dump Void
- Mamatwan Mining Right Area
- Mamatwan Sinterfontein Waste Rock Dump
- Tshipi Eastern Waste Rock Dump
- Boundary Pillar
- Tshipi Surface Use Area
- Tshipi Mining Right Area
- Main Roads
- Power Line
- Rivers and Streams
- 20m Contour Lines
- Farm Boundaries
- Farm Portions

0      500      1 000  
Meters

Scale: 1:28 500 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 2**  
**Local Setting**



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This BAR will be distributed for a 30 day comment period from **25 April 2019 to 31 May 2019** in order to provide I&APs with an opportunity to comment on any aspect of the proposed project and the findings of the BA process. Copies of the full report will be made available on the SLR website (at <https://slrconsulting.com/za/slr-documents/>) and at the Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Hotazel Public Library and Kathu Public Library, Black Rock Library. Electronic copies (compact disk) of the report are available from SLR, at the contact details provided below.

All comments received during the review process will be addressed in the BAR. Issues and concerns raised including responses are included in Section 7.3.

**SLR Consulting (South Africa) (Pty) Ltd**

Attention: Natasha Smyth

PO Box 1596, Cramerview 2060 (if using post please call SLR to notify us of your submission)

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# **PART A - SCOPE OF ASSESSMENT AND BASIC 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 BAR are provided in Table 1-1 below.

**TABLE 1-1: DETAILS OF THE EAP**

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	<a href="mailto:nsmyth@slrconsulting.com">nsmyth@slrconsulting.com</a>	-

SLR does not have any interest in the proposed project other than fair payment for consulting services rendered as part of the EIA process. An undertaking by SLR is provided in Section 17.

### 1.2 EXPERTISE OF THE EAP

#### 1.2.1 SLR PROJECT TEAM

Natasha Smyth holds a BSc Honours degree in Geography and Environmental Management and has approximately ten 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 Management) with the South African Council for Natural Scientific Professions (SACNASP) (Appendix B). Alex Pheiffer has over 16 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 LOCATION OF ACTIVITY

### 2.1 LOCATION OF OVERALL ACTIVITY

A description of the property on which the proposed project is located is provided in Table 2-1.

**TABLE 2-1: DESCRIPTION OF THE PROPERTY**

Description	Details
Farm Names	The farm Sinterfontein 748 (Application area).
Application area (ha)	Approximately 4ha will be disturbed as part of the proposed project.
Magisterial district	The mine is located within the Kuruman Magisterial District and in the John Taolo Gaetsewe District Municipality.
Distance and direction from nearest town	The proposed project site is located approximately 25km south of the town Hotazel (Refer to Figure 1).
21 digit Surveyor General Code for each farm portion	The farm Sinterfontein 748 - C0410000000074800000
Co-ordinates (Refer to Figure 2)	<ul style="list-style-type: none"> <li>• North eastern corner: 22° 58' 37.963"E and 27° 22' 49.092"S</li> <li>• South eastern corner: 22° 58' 42.484"E and 27° 22' 51' 948"S</li> <li>• South western corner: 22° 58' 20.2"E and 27° 23' 16' 064"S</li> <li>• North western corner: 22° 58' 13.362"E and 27° 23' 17"146"S</li> </ul>

### 2.2 LOCALITY MAP

The regional and local settings are illustrated in Figure 1 and Figure 2, respectively.

### 3 DESCRIPTION OF THE SCOPE OF THE ACTIVITY

#### 3.1 LISTED AND SPECIFIED ACTIVITIES

The proposed project triggers various activities for which authorisation are required in terms of the NEMA, NEM:WA and NWA. The associated listed or specified activities are summarised in the below. The legislative context pertaining to the relevant listed and specified activities is outlined in Section 4.

**TABLE 3-1: PROJECT ACTIVITIES AND ASSOCIATED LISTED ACTIVITIES**

Description of the proposed project activity	Aerial extent of the activity (ha)	Listed activity (mark with an x)	Listed activity number, applicable listing notice and activity description
<b>National Environmental Management Act (No. 107 of 1998), as amended</b>			
Clearing of vegetation in areas designated for the merging of the WRDs	Approximately 4 ha	x	<b>Activity 27 of Listing Notice 1 (GNR 983)</b> <i>The clearance of an area of 1 ha or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for–</i> (i) <i>the undertaking of a linear activity; or</i> (ii) <i>maintenance purposes undertaken in accordance with a maintenance management plan.</i>
Stripping of topsoil and sub-soil			
Adaptation of stormwater management infrastructure such as establishment of berms.	This forms part of the overall 4 ha area of disturbance		<b>This activity is triggered as more than 1ha but less than 20ha of indigenous vegetation will be disturbed as part of the proposed project.</b>
Stockpiling of waste rock in the void between the Mamatwan Sinterfontein and the Tshipi Eastern WRD.	This forms part of the overall 4 ha area of disturbance	x	<b>Activity 34 of Listing Notice 1 (GNR 983)</b> <i>The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding –</i> (i) <i>Where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act , 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;</i> (ii) <i>The expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or</i> (iii) <i>The expansion is directly related to aquaculture facilities or infrastructure</i>

Description of the proposed project activity	Aerial extent of the activity (ha)	Listed activity (mark with an x)	Listed activity number, applicable listing notice and activity description
			<p>where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.</p> <p><b>The proposed project requires the amendment of the existing IWUL to cater for the increase in WRD capacity.</b></p>
Continued use of approved facilities and services.	Not applicable as this forms part of the current approved mining footprint.	N/A	N/A
<b>National Environmental Management Waste Act (No. 59 of 2008), as amended</b>			
Stockpiling of waste rock in the void between the Mamatwan Sinterfontein and the Tshipi Eastern WRD.	Approximately 4 ha	x	<p><b>Activity 13 in Category A (GNR 921)</b></p> <p><i>The expansion of a waste management activity Listed in Category A or B of this Schedule, which does not trigger an additional waste management activity of this Schedule.</i></p> <p><b>The extension and increase in capacity of Mamatwan's Sinterfontein WRD.</b></p>
<b>National Water Act (No. 36 of 1998)*</b>			
Stockpiling of waste rock in the void between the Mamatwan Sinterfontein and the Tshipi Eastern WRD.	Approximately 4 ha	x	<p><b>Section 21(g) of the NWA</b></p> <p><i>Disposing of waste in a manner which may detrimentally impact on a water resource.</i></p> <p><b>The extension and increase in capacity of Mamatwan's Sinterfontein WRD.</b></p>

\* A separate IWUL amendment application will be submitted to the DWS for the Section 21 water use but has been highlighted in this section for completeness purposes.

## 3.2 DESCRIPTION OF THE ACTIVITIES

This section has been compiled using information provided by the MMT project team.

### 3.2.1 PROPOSED PROJECT OVERVIEW

An 18m wide (on surface) boundary is located between the MMT and the Tshipi Borwa Mine Figure 2. Tshipi and South32 have approval to mine the 18m wide boundary pillar. Additional capacity is required to store waste rock generated as part of mining the boundary pillar. To cater for the additional storage, it is proposed that the Mamatwan Sinterfontein and the Tshipi eastern WRDs are merged to fill the void between the two dumps.

An overview of the activities and infrastructure are provided in Table 3-2 below.



**TABLE 3-2: LIST OF PROPOSED PROJECT ACTIONS / ACTIVITIES / PROCESSES**

Main activity/ process	Sub-activities	Construction Phase	Operation Phase	Decommissioning Phase	Closure Phase
<b>Site preparation</b>	Vegetation clearing in accordance with the DAFF guidelines.	On-going			
	Removal of fencing	On-going			
<b>Earthworks</b>	Stripping of topsoil and sub-soil	On-going			
	Adaptation of stormwater infrastructure such as berms for the diversion of clean and dirty water	On-going	On-going maintenance	As required	As required
<b>Waste rock disposal (mineralised waste)</b>	Stockpiling of waste rock in the void between the Mamatwan Sinterfontein and the Tshipi Eastern WRD (Hauling, tipping and dozing of waste rock)		On-going		
<b>Continued use of existing infrastructure and services</b>	Continued use of existing transport system such as internal haul roads	On-going	On-going	As required	As required
	Continued use of general and hazardous waste management activities (collection, storage and disposal)	On-going	On-going	As required	As required
	Continued use of site support services such as access and security control and maintenance of fencing for security	On-going	On-going	As required	As required
	Continued use of existing contractors and workers	On-going	On-going	As required	As required
	Continued site management activities such as monitoring, inspections, maintenance and continued environmental awareness training and emergency response awareness training	On-going	On-going	As required	As required
	Rehabilitation			As required	As required
	Aftercare and maintenance such as monitoring and maintenance of rehabilitated areas.				As required

### 3.2.2 OVERVIEW OF EXISTING OPERATIONS

Information in the following section was sourced from the approved EIA and EMPr compiled by Jones and Wagener (JAWS, 2005) and the project team.

#### 3.2.2.1 Mining and mineral processing

MMT consists of an open pit operation that commenced in 1963. This pit is still operational, and is being extended to the north and west. The current run of mine for MMT is in the order of 3 million tons per annum. Manganese ore is sold to both the local and international markets. The table below provides a summary of the mining and mineral processing activities that take place at the MMT.

**TABLE 3-3: OVERVIEW OF MMT EXISTING OPERATIONS**

Activity	Detail
Stripping and stockpiling of topsoil and waste rock	MMT is a conventional opencast operation in that topsoil and waste rock is removed to uncover the manganese ore body using truck and shovel methods. Topsoil is transported via truck to designated topsoil stockpile areas for later use as part of rehabilitation. Waste rock is stripped and transported to one of the designated WRDs at the MMT. Waste rock is either backfilled into the open pit or used to flatten the slopes of existing dumps.
Access to open cast workings	Ore is drilled and blasted, and hauled using front end loaders and shovels to the "in-pit" primary crusher. Crushed ore is conveyed to a product stockpile area (ROM stockpile) near the mineral processing plant. Excess ore is stored and crushed as required.
In pit crushing and screening	Oversize ore is crushed using a "in-pit" jaw crusher to reduce the size of the ore for further downstream processes. The crushed ore is conveyed to a designated Run of Mine (ROM) stockpile area.
Crushing, screening and washing (ore processing)	Ore from the ROM stockpile is conveyed to two parallel circuits comprising scalping screens, cone crushers and double-deck sizing screens and a horizontal dewatering screen at the processing plant.  Lumpy material (- 75 +6 MM) from the processing plant is stockpiled in marked allocated lumpy product stockpile area (Gantry 7) prior to being sent to the load out station using front end loaders. The product is conveyed to railway trucks via the load out section for sale to third parties.  Slimes material from the processing plant is sent to the tailings dam for disposal.
DMS and sintering	The natural Mamatwan ore ideally lends itself to upgrading by technologically advanced beneficiation processes. In this regard, the -40+6MM feed from the ore processing plant is stockpiled (KAWA product stockpile Gantry 6) prior to being sent to the Dense Medium Separation Plant (DMS) via conveyer. The dense medium separation plant can be used to beneficiate the ore prior to sintering by recovering the upgradeable portion of the ore body. The product (low grade and high grade) from the DMS is stored on the sinter feed stockpiles prior to being subjected to the sinter plant process. Correctly graded material and size (M1FT product) from the DMS is stockpiled prior to be sent to the loading and dispatch.

Activity	Detail
	<p>Fines (-6+1MM) from the ore processing plant is conveyed directly to the sinter plant.</p> <p>Material this is not sent to the sinter plant is stockpiled for rework.</p> <p>During the sintering process calcium carbonate and other impurities are driven off resulting in an increase in the grade. In this regard, the sinter plant generates a high and standard grade sinter product which is conveyed to loading and dispatching of MMT products. Fugitive dust is extracted from the process through a series of extraction ducts with the particulate matter being captured in bag houses. Dust from the baghouses are either recycled back into the sinter process or captured in bulk bags for sale as reduced sinter fines. Off gas and particulate matter is extracted and scrubbed.</p>

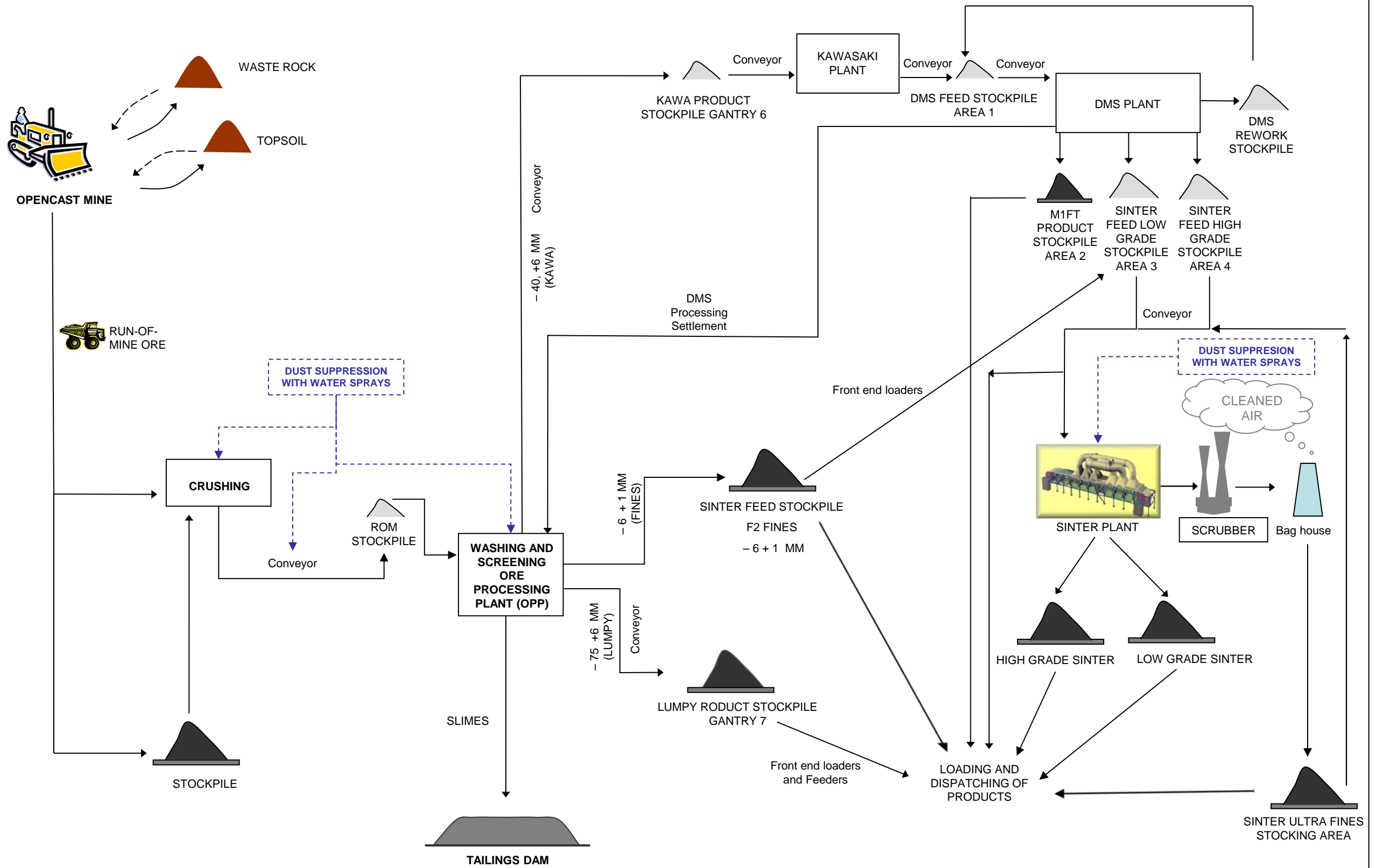
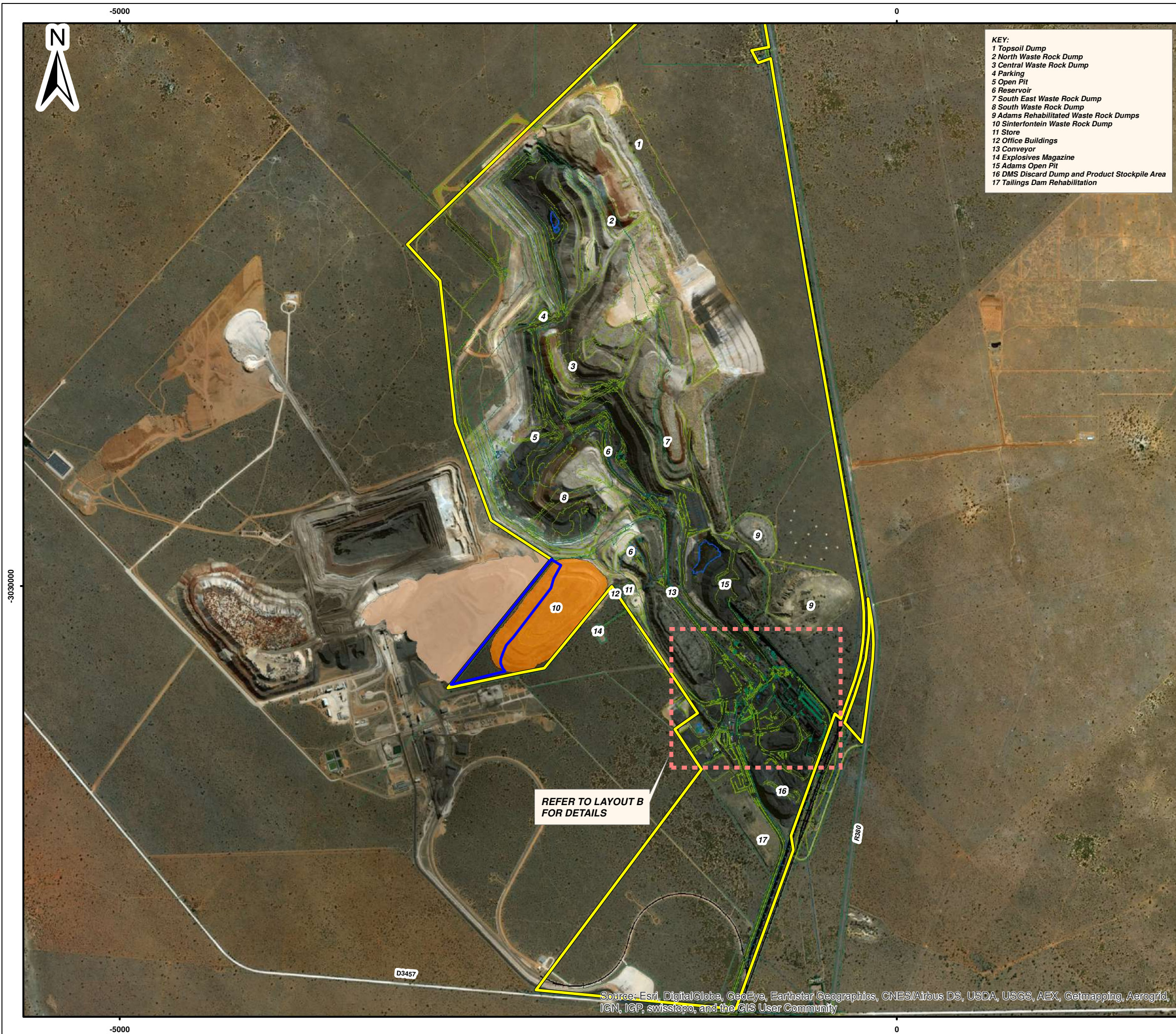


FIGURE 3: PROCESS FLOW DIAGRAM

### 3.2.2.2 Current Infrastructure

An overview of infrastructure currently located at the MMT is illustrated in Figure 4 and Figure 5 and includes the following:

- Topsoil stockpiles
- WRDs (North WRD, Central WRD, South east WRD, South WRD, Sinterfontein WRD, DMS discard dump and Adams pit rehabilitated WRD's)
- Open pit and Adams open pit
- Crushing and screening (in-pit crusher, Kawasaki crushers, ROM cone crusher)
- Product stockpile area
- DMS plant
- Sinter plant
- Coke
- Ore processing plant
- Tailings dam (rehabilitated)
- Transport infrastructure (conveyors, internal haul roads, loadout station and weighbridge and railway siding)
- Water storage (Water tanks, water reservoirs and pump house)
- Stores
- Substation and MMC (loadout station, in-pit crusher, sinter plant, ore processing plant, ROM)
- Sewage treatment plant
- Office buildings, ore processing plant office, main office, sinter offices, walkways and change house
- Parking (north pit parking) and parking
- Clinic
- Workshops, Barloworld workshop, sinter workshops, Ore processing plant workshop
- Washbays
- Tyre bay
- Tea room
- Waste management areas (general and hazardous waste yard)
- Soil remediation facility
- Diesel refuelling and storage facilities (fuel bay)
- Main gate with security and access control
- Explosive magazine
- Laboratory



- KEY:**
- 1 Topsoil Dump
  - 2 North Waste Rock Dump
  - 3 Central Waste Rock Dump
  - 4 Parking
  - 5 Open Pit
  - 6 Reservoir
  - 7 South East Waste Rock Dump
  - 8 South Waste Rock Dump
  - 9 Adams Rehabilitated Waste Rock Dumps
  - 10 Sinterfontein Waste Rock Dump
  - 11 Store
  - 12 Office Buildings
  - 13 Conveyor
  - 14 Explosives Magazine
  - 15 Adams Open Pit
  - 16 DMS Discard Dump and Product Stockpile Area
  - 17 Tailings Dam Rehabilitation

- Legend**
- Mamatwan Infrastructure
  - Sinterfontein Waste Rock Dump Void
  - Mamatwan Mining Right Area
  - Mamatwan Sinterfontein Waste Rock Dump
  - Tshipi Eastern Waste Rock Dump

0 500 1 000 Meters  
 Scale: 1:28 500 @ A3  
 Projection: Transverse Mercator  
 Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 4**  
**Current Infrastructure Layout A**

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- KEY:**
- 4 Parking
  - 6 Reservoir
  - 11 Stores
  - 13 Conveyor
  - 18 Wash Bay
  - 19 Workshop
  - 20 Fuel Bay
  - 21 Laboratory
  - 22 Barlows Workshop
  - 23 Ore Processing Plant Sampling Office
  - 24 Ore Processing Plant Workshop
  - 25 Tea Room
  - 26 Tyre Bay
  - 27 Walkway
  - 29 Ore Processing Plant
  - 30 Railway Siding
  - 31 Sewage Treatment Plant
  - 32 Kawasaki Crushers
  - 34 Internal Haul Roads
  - 36 Main Offices
  - 37 General and Hazardous Waste Yard
  - 38 Change House
  - 39 Clinic
  - 40 Main Gate
  - 41 Security
  - 42 Workshop
  - 43 Sinter Offices and Workshops
  - 44 Sinter Plant
  - 45 Load Out Station

- Legend**
- Mamatwan Mining Right
  - Mamatwan Infrastructure

0 50 100 Meters

Scale: 1:3 500 @ A3  
 Projection: Transverse Mercator  
 Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 5**  
**Current Infrastructure Layout B**  
**(Zoomed In)**

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

### 3.2.3 DESCRIPTION OF PROPOSED ACTIVITY

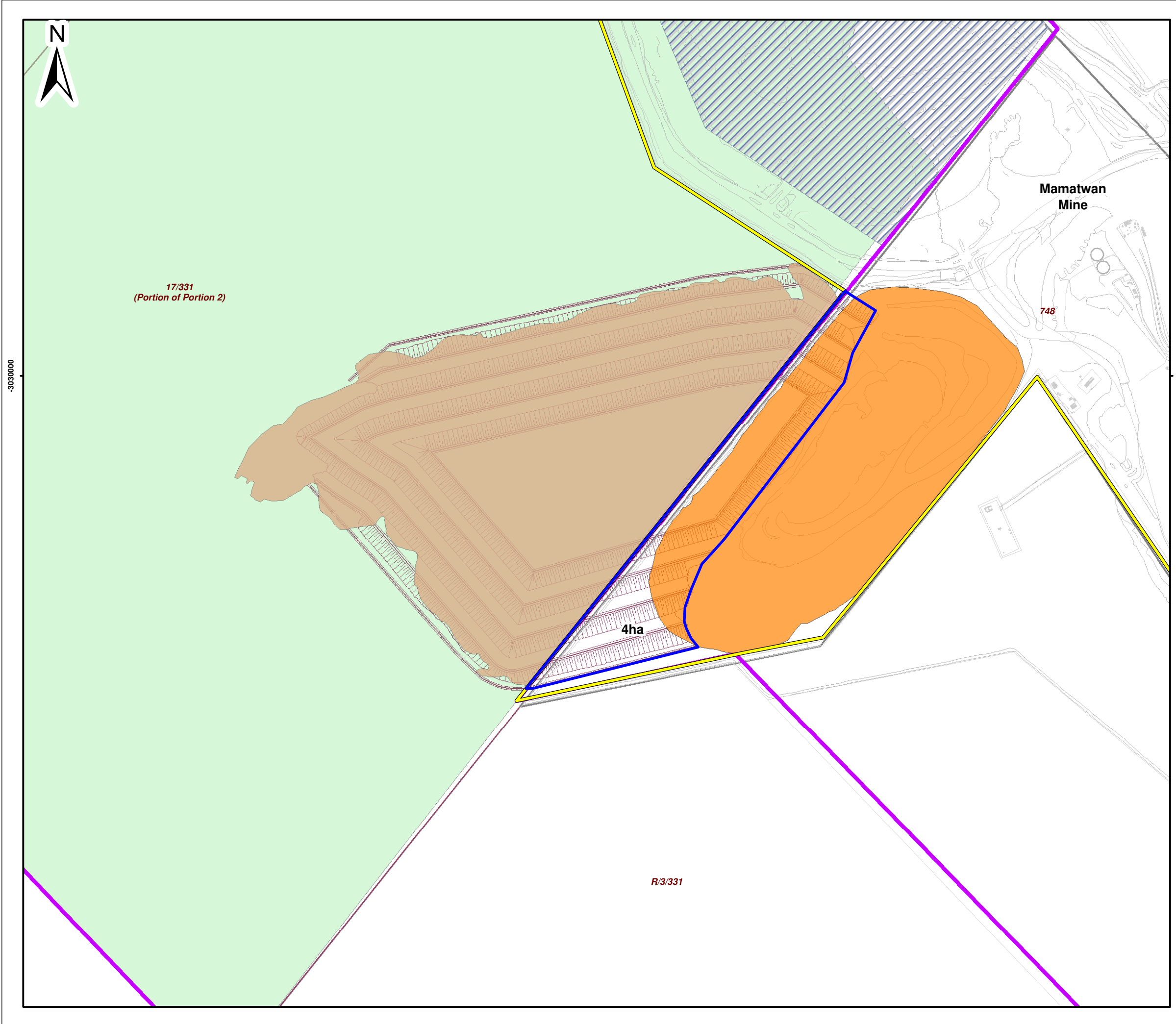
The proposed project includes the merging of the Sinterfontein WRD and the Tshipi eastern WRD. In this regard, the Mamatwan Sinterfontein WRD would be extended in a north-westerly and south-westerly direction to merge with the Tshipi eastern WRD in order to fill the narrow void between these two WRDs. Images showing the current void between the Mamatwan Sinterfontein WRD and the Tshipi eastern WRD are included in Figure 6 below. A site layout plan showing the conceptual layout of the WRD merge is illustrated in Figure 7.

Further detail pertaining to the proposed activity is provided below.

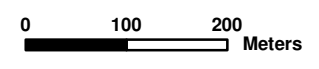


**FIGURE 6: CURRENT VOID BETWEEN MAMATWAN SINTERFONTEIN WRD (RIGHT) AND THE TSHIPI EASTERN WRD (LEFT)**





- Legend**
- Sinterfontein Waste Rock Dump Void
  - Final Merged Waste Rock Dump
  - Mamatwan Mining Right Area
  - Tshipi Eastern Waste Rock Dump
  - Mamatwan Sinterfontein Waste Rock Dump
  - Tshipi Surface Use Area
  - Tshipi Mining Right Area
  - Boundary Pillar
  - Farm Boundaries
  - Farm Portions



Scale: 1:7 500 @ A3  
 Projection: Transverse Mercator  
 Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 7**  
**Conceptual Site Layout Illustrating the WRD Merge**



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### 3.2.3.1 Mining of the boundary pillar and filling the void

As part of mining the 18m wide boundary pillar, Tshipi would be responsible for stripping waste, drilling and blasting the ore on behalf of both parties. Waste rock would be deposited onto each party's WRD (Tshipi eastern and Mamatwan Sinterfontein). Ore would be loaded by each party and delivered to their respective stockpile areas.

The commercial agreement between both Tshipi and Mamatwan is included in Appendix D.

### 3.2.3.2 WRD Design

The management of residue stockpiles and deposits must be undertaken in accordance with Regulation 73 of the MPRDA Regulations (GNR 527 of 2004), as amended. In this regard, the design features of the Sinterfontein WRD are presented in Table 3-4 . An illustration of the detailed design of the merged WRD is provided in Figure 8.

**TABLE 3-4: DESIGN FEATURES OF THE WRD**

Feature	Detail
Physical dimensions	Total area of merged WRD: 54 Ha Total height of merged WRD: 80 m Total capacity of merged WRD: 24 million m3 Sinterfontein WRD extension footprint: 4 ha
Physical characteristics	The material comprises rock including sand, calcrete, clay and (uneconomic) banded iron. The water content is expected to be about 5%. The void ratio is approximately 0.5.
Management, transport, placement	Waste rock will be loaded into mining dump trucks and hauled to the Sinterfontein WRD where it is tipped and dozed into final position.
Diversion of clean water and containment of dirty water	Water management infrastructure such as berms around the existing WRD would be adapted as required to manage run-off from the WRD.
Topsoil stripping	Topsoil in the WRD void will be stripped and stockpiled at existing stockpile areas at the mine in accordance with existing approved soil conservation procedures. Stripping and stockpiling of topsoil is done immediately in advance of dumping. Topsoil will be stripped to a depth of at least 0.2m. The first 0.15m of topsoil should be stripped separately and not mixed with the deeper horizons.
Lining	The foundations will be designed taking cognisance of the geotechnical conditions and the base preparation will be in accordance with the required barrier system determined by a waste classification in accordance with regulations R632 and R634, promulgated in terms of NEM:WA. In this regard, the WRD will need to conform to Class D liner specification (Rip and Re- Compact).
Side slopes	The slopes of the WRDs will include 20m lifts with wide platforms, the benches are thirty metres (30 m) wide, which reduces the overall side slopes. A bench face angle of 35 degrees will be ensured.
Under drains	No under drainage has been provided. Surface runoff is directed around the WRD and dump surfaces provide positive drainage to prevent ponding and infiltration.

Feature		Detail
Access and access control		Access to the Sinterfontein WRD will be via existing haul roads within the MMT surface use area. A perimeter fence has been installed around the perimeter of the MMT preventing unauthorised access.
Monitoring		A monitoring strategy has been developed to manage excessive surface cracking, bulging, foundation creep, and seepage at the WRD.
Dust control		During operation roads are watered using water and/or chemical solutions for dust suppression. During the post operational phase no measures are necessary due to the rehabilitation of the WRDs. Monitoring forms part of the overall site monitoring.
Closure		<p>The WRD should be shaped to ensure the area is free draining (i.e no ponding of water on the top surface post closure. The WRD side slopes to be confirmed through on-going field trails. The WRD should be capped with a minimum of 300 mm soil/growth medium material. The capping thickness should be confirmed through on-going field trails.</p> <p>No active groundwater protection measures are envisaged during closure given the relatively low pollution potential of the residual waste rock material. In the event that water quality monitoring around any WRD indicates that the WRDs are causing pollution, additional management measures will be investigated in consultation with a qualified specialist.</p>
Rehabilitation	Revegetation	WRD to be revegetated using a mix of indigenous grasses (i.e. dry seeding) and trees/shrubs (i.e. hand planting of seedlings). Vegetation species to be confirmed through ongoing field trials.
	Erosion control	Erosion management measures and/or mitigation measures to be confirmed through ongoing field trials.
	Maintenance and aftercare	Maintenance and aftercare period to be confirmed through ongoing field trials.
	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.

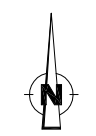
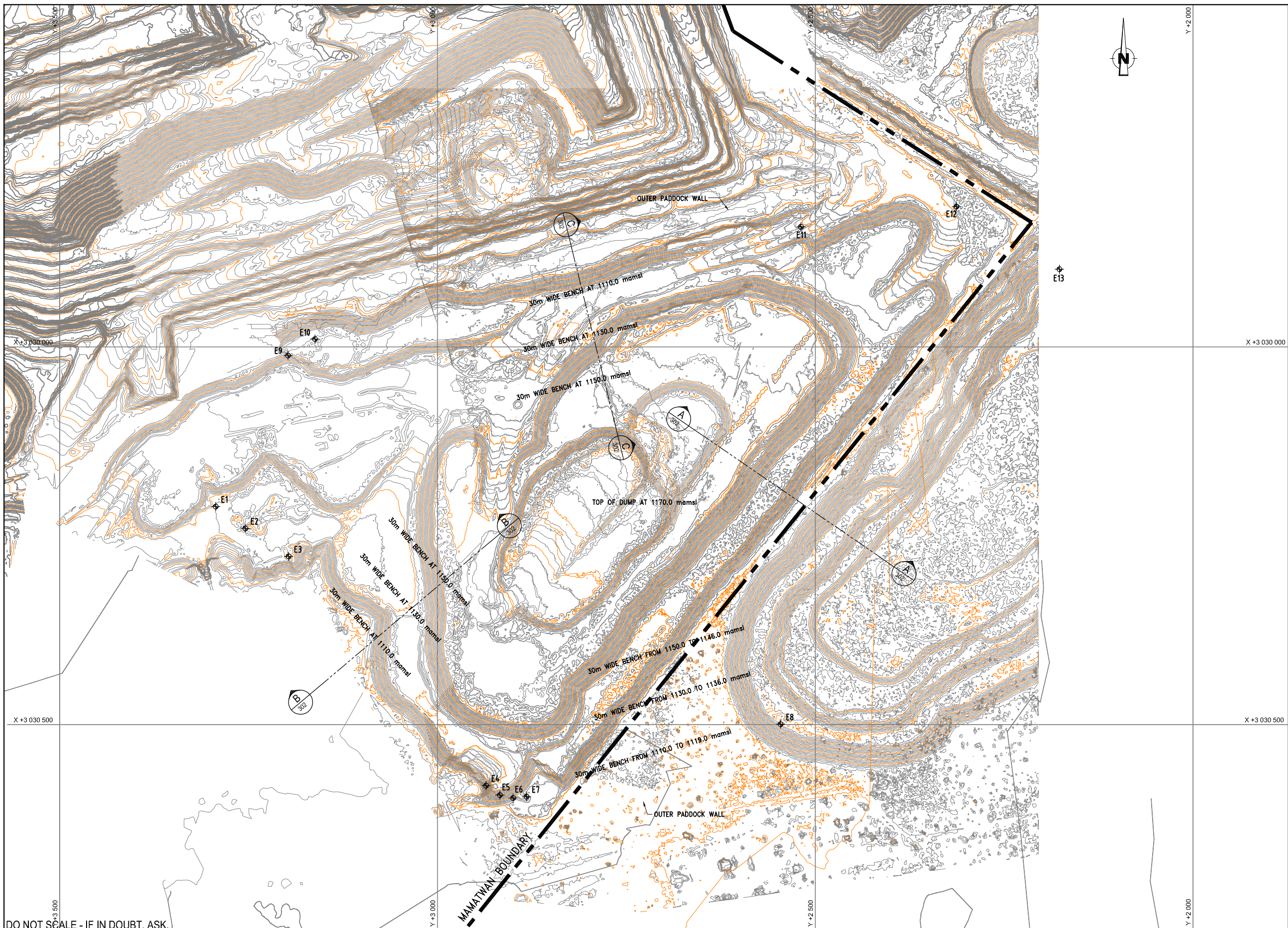
**Safety classification**

The safety classification was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of the MPRDA. The summarised classifications are included in Table 3-5 below.

**TABLE 3-5: SAFETY CLASSIFICATION CRITERIA**

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

Criteria No.	Criteria	Comment	Safety Classification	
2	No. of Workers in Zone of Influence	<10 (Low hazard)	The Sinterfontein WRD is located near the open pit and as such mine workers may be located in the zone of influence.	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. WRD characteristics 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 WRD.	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		



GENERAL NOTES:

EASTERN WASTE ROCK DUMP AREA AND VOLUME SCHEDULE		
	EXISTING WRD	NEW WRD
FOOTPRINT AREA	540 188 m <sup>2</sup>	540 188 m <sup>2</sup>
VOLUME	12 399 437 m <sup>3</sup>	11 555 689 m <sup>3</sup>
TOTAL VOLUME	23 955 126 m <sup>3</sup>	

COORDINATE LIST

EASTERN WASTE ROCK DUMP		
POINT	Y-COORD	X-COORD
CONST:		
E1	3293.403	3030211.231
E2	3254.290	3030240.121
E3	3196.884	3030277.302
E4	2935.601	3030580.556
E5	2917.248	3030593.174
E6	2899.857	3030597.155
E7	2882.050	3030595.181
E8	2545.834	3030499.342
E9	3197.700	3030011.342
E10	3162.054	3029989.636
E11	2518.880	3029840.955
E12	2313.087	3029814.256
E13	2176.770	3029897.235

DO NOT SCALE - IF IN DOUBT, ASK.

REFERENCE	
710.20008.00060-301	EASTERN WASTE ROCK DUMP - TYPICAL CROSS SECTIONS SHEET 1
DRAWING NUMBER	TITLE

REVISIONS				
No.	DESCRIPTION	BY	CHKD	DATE
0	ISSUED FOR INFORMATION	T.G	D.A.S	19.07.17

**SLR**

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APPROVED BY CLIENT			
DESIGNATION	DATE	INITIALS	SIGN
1.)			
2.)			

APPROVED BY SLR			
DESIGNATION	DATE	INITIALS	SIGN
DRAUGHTSMAN	25.05.18	T.G	
DESIGN ENGINEER	25.05.18	D.A.S	
PROJECT DIRECTOR	25.05.18	F.VH	
PROFESSIONAL ENGINEER (REG No.)	25.05.18	D.A.S	

Mamatwan Mine		SCALE
Detailed Design of the WRD Merge		1:2500
		CO-ORD SYSTEM
		SHEET
		1 OF 1
		A1
DRAWING NUMBER:	720.19136.00001 Figure 8	REV: A

### ***Environmental classification***

In accordance with Regulation 5 of GNR 632 of the NEM:WA, waste rock stockpiles need to be classified taking into account Regulation 8 of GNR 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 (GNR 635 of 2013); and
- The National Norms and Standards for disposal of waste to landfill (GNR 636 of 2013).

For the purpose of the proposed project, reference has been made to a waste assessment undertaken by Golder Associates (Golder, 2016) for waste rock generated at the Tshipi Borwa Mine. Reference to this study is deemed sufficient given that the waste rock composition at the MMT is expected to be similar to that of Tshipi given the close proximity of the mines and that both parties target the same ore body.

The results of the waste assessment indicate that waste rock is classified as a Type 1 waste, which requires a Class A liner, which consists of a compacted clay liner, leachate detection, geotextile membranes and geotextile filters. It should be noted that the Sinterfontein WRD was established prior to the promulgation of this legislation.

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). The risk based assessment enables an evaluation of the efficacy of an 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, rather than a formulaic application of the Norms and Standards for the following reasons:

- A Class A liner is impractical for a WRD on the basis of geotechnical properties given that the liner is likely to fail;
- The leachable concentrations of all the constituents are below the LCTO 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 7.4.1.1).

Taking the above into consideration Golder recommended, via a formal motivation letter to the DWS, that a Class D liner (stripping topsoil and base preparation) is considered appropriate for the proposed WRDs at the Tshipi Borwa Mine. It follows that the same applies to the MMT for the Sinterfontein WRD.

### 3.2.3.3 Continued use of existing support services

#### ***Transport System – Site Access and Roads***

The proposed project will not require the establishment of any new roads. Existing internal haul roads will be utilised to access the Sinterfontein WRD. In addition to this, existing contractors will be utilised for the stockpiling of waste rock material and as such the proposed project will not result in any changes to the existing transport system.

#### ***Stormwater Management***

The proposed project will not result in the establishment of any new stormwater containment facilities; rather existing stormwater infrastructure such as berms will be adapted to divert clean and dirty water.

#### ***Power and water***

The proposed project will not result in an increase in power and water supply at the MMT. This will form part of existing services and capacities at the MMT.

#### ***Employment***

The proposed project will not generate additional job opportunities. Rather existing contractors at the MMT will be utilised.

#### ***Non-mineralised waste management***

Existing waste management facilities will be utilised as part of the proposed project. In this regard, waste is temporary stored onsite prior to being collected by contractors for removal off site.

## 4 POLICY AND LEGISLATIVE CONTEXT

This chapter outlines the key legislative requirements applicable to the proposed project and outlines the guidelines, policies and plans that have been taken into account during the BA process.

### 4.1 LEGISLATIVE CONSIDERATION IN THE PREPARATION OF THE BASIC ASSESSMENT REPORT

In accordance with the EIA Regulations 2014 (as amended) and the DMR BAR template requirements, all legislation and guidelines that have been considered in the BA process must be documented. Table 4-1 below provides a summary of the applicable legislative context.

**TABLE 4-1: 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), as amended	Introduction and Table 4-3	<p>Authorisation is required from the DMR in terms of Section 102 of the MPRDA to amend the existing EMP and mine works programme to take cognisance of the proposed project.</p> <p>MMT will apply for a Section 102 Amendment in terms of the MPRDA. This EIR will support this application.</p>
Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) Regulations (GNR 527 of 2004), as amended	Section 3.2.3.1	The design features of the WRD took into consideration requirement for the management of residue stockpiles and deposits.
National Environmental Management Act No. 107 of 1998) (NEMA), as amended	Introduction, Section 3.1 and Table 4-3	The proposed project incorporates activities listed in Government Notice Regulation (GNR) 983 (Listing Notice 1; as amended) (refer to Table 3-1). Since the proposed project includes activities listed in Listing Notice 1, a Basic Assessment Report is required in order for the DMR to consider the application for environmental authorisation.
Regulations 982 of 4 December 2014 (EIA Regulations), as amended		A combined NEMA and NEM:WA application has been lodged with DMR.
National Environmental Management: Waste Act (No 59 of 2008) (NEM:WA), as amended	Introduction and Section 3.1	<p>The proposed project incorporates a waste management activity listed in GNR 921 (as amended) (refer to Table 3-1). Since the proposed project includes activities listed in Category A, a Basic Assessment Report is required in order for the DMR to consider the application for a WML.</p> <p>A combined NEMA and NEM:WA application has been lodged with DMR.</p>



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?
Waste Classification and Management Regulations (GNR 634 of 23 August 2013) with reference to the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR 635 of 23 August 2013) and disposal of waste to landfill (GNR 636 of 2013)	Section 3.2.3.1	Waste rock stockpiles need to be classified in terms of GNR 632 of the NEM:WA. For the purpose of the proposed project, reference has been made to a waste assessment undertaken by Golder Associates (Golder, 2016) for waste rock generated at the Tshipi Borwa Mine. Reference to this study is deemed sufficient given that the waste rock composition at the MMT is expected to be similar to that of Tshipi given the close proximity of the mines and that both parties target the same ore body. The results of the waste assessment indicated that a Class D liner is sufficient for the proposed project.
National Water Act (No. 36 of 1998) (NWA), as amended	Introduction and Section 3.1	The proposed project triggers a water use activity listed in Section 21 of the NWA (refer to Table 3-1). As such, a WUL is required from the DWS in terms of the NWA.
Regulation 704 of 1999 in terms of the NWA	Section 26	The proposed project takes into consideration the separation of clean and dirty water systems through the adaptation of berms around the WRD to ensure that clean water is diverted away from the site and that dirty water is prevented from entering the natural environment.
Northern Cape Nature Conservation Act, No. 9 of 2009	Section 7.4.1.5, 9 and 26	No protected plants may be removed, damaged, disturbed or relocated without a valid permit. Similarly no active bird nests may be disturbed without a permit. While protected plants and active bird nests have not been identified within the proposed study area this has been taken into consideration in the proposed project.
National Forest Act No. 84 of 1998	Section 7.4.1.5, 9 and 26	No protected tress species may be disturbed without a valid permit. While protected plants have not been identified within the proposed study area this was considered as part of the proposed project.
Alien Invasive Species Regulations GNR 598 of 2014 in terms of the NEM:BA	Section 7.4.1.5, 9 and 26	Biodiversity was taken into account as part of project planning and in the assessment of potential impacts.
Alien and Invasive Species List, GNR 864 of 2016		
National Freshwater Ecosystem Priority Areas 2011 (NFEPA)		
National Protected Areas Expansion Strategy 2008 (NPAES)		
Northern Cape Critical Biodiversity Areas (2016)		
Mining Biodiversity Guideline (2012)		

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?
Important Bird and Biodiversity Areas (IBAs)		
National Biodiversity Assessment		
National Threatened Ecosystems (2011)		
South African Protected Areas Database		
National Heritage Resource Act (No. 25 of 1999)	Section 7.4.1.12, Section 0 and Section 26	Heritage/cultural and palaeontological resources were taken into account as part of project planning and in the assessment of potential impacts.

#### 4.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998

The National Environmental Management Act, 1998 (No. 107 of 1998), as amended, establishes principles and provides a regulatory framework for decision-making on matters affecting the environment. All organs of state must apply the range of environmental principles included in Section 2 of NEMA when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. The participation of I&APs is stipulated, as is that decisions must take into account the interests, needs and values of all I&APs.

Chapter 5 of NEMA provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 provides a framework for granting of environmental authorisations. To give effect to the general objectives of Integrated Environmental Management, the potential impacts on the environment of listed or specified activities must be considered, investigated, assessed and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment, management and communication of the potential impacts.

In terms of the management of impacts on the environment, Section 24N details the requirements for an EMPr.

#### EIA REGULATIONS 2014

The EIA Regulations, 2014 (as amended by GN No. 326 of 7 April 2017) promulgated in terms of Chapter 5 of NEMA provide for control over certain listed activities. These listed activities are detailed in Listing Notice 1 (as amended by GN No. 327 of 7 April 2017), Listing Notice 2 (as amended by GN No. 325 of 7 April 2017) and Listing Notice 3 (as amended by GN No. 324 of 7 April 2017). The undertaking of activities specified in the Listing Notices is prohibited until Environmental Authorisation has been obtained from the competent authority. Such Environmental Authorisation, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations, 2014.

The EIA Regulations, 2014 (as amended) set out the procedures and documentation that need to be complied with when applying for Environmental Authorisation. A Basic Assessment process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notices 1 and/or 3 and a Scoping and EIA process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notice 2. The proposed project triggers activities in terms of Listing Notice 1 (see Table 3-1) and therefore a BA process is required in order for the DMR to consider the application in terms of NEMA.

#### 4.1.2 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008

The National Environmental Management: Waste Act, 2008 (No. 59 of 2008) (NEM:WA) regulates all aspects of waste management and has an emphasis on waste avoidance and minimisation. NEM:WA creates a system for listing and licensing waste management activities which may have a detrimental effect on the environment.

##### LISTED WASTE MANAGEMENT ACTIVITIES

Listed waste management activities are included in GNR 921 of November 2013. Category A and Category B listed waste management activities above certain thresholds are subject to a process of impact assessment and licensing. Category C listed waste management activities do not require a waste management license but are subject to the provisions of National Norms and Standards (GNR 926, November 2013).

The proposed project triggers an activity in Category A activity (see Table 3-1), and therefore a BA process is required in order for the DMR to consider the application in terms of NEM:WA.

#### 4.1.3 NATIONAL WATER ACT, 1998

The National Water Act, 1998 (No. 36 of 1998) (NWA) provides a legal framework for the effective and sustainable management of water resources in South Africa. It serves to protect, use, develop, conserve, manage and control water resources as a whole, promoting the integrated management of water resources with the participation of all stakeholders. This Act also provides national norms and standards, and the requirement for authorisation of water uses listed in Section 21 of the Act. The competent authority is the DWS.

The proposed project requires authorisation of a water use listed in Section 21 of the Act (see Table 3-1), and therefore a WUL amendment application is required in order for the DWS to consider the application in terms of the NWA.

## 4.2 GUIDELINES, POLICIES, PLANS AND FRAMEWORKS

The guidelines, policies and plans listed in Table 4-2 have been taken into account during the BA process and as part of specialist studies, where applicable.

**TABLE 4-2: GUIDELINE AND POLICY FRAMEWORK**

Guideline	Governing body	Relevance
Public participation guideline in terms of NEMA (2017)	Department of Environmental Affairs	The purpose of this guideline is to ensure that an adequate public participation process is undertaken during the BA process.
Guideline on need and desirability (2017)	Department of Environmental Affairs	This guideline informs the consideration of the need and desirability aspects of the proposed project.
South African Code of Practise for Mine Residue Deposits (SANS: 10286:1998)	DMR	The safety classification of the Sinterfontein WRD was undertaken in accordance to this code of practise.
Joe Morolong Local Municipal Integrated Development Plan 2016	Joe Morolong Local Municipality	The Joe Morolong Local Municipality Integrated Development Plan is the principle strategic instrument guiding all planning, management, investment and development within the province in order to provide best solutions towards sustainable development.
Northern Cape Provincial Spatial Development Framework (NCPSDF, 2012)	Department of Rural Development and Land Reform	The NCPSDF is needed for coherent prioritisation of projects within a spatial economic framework that takes cognises of environmental realities and the imperative to create a developmental state. The NCPSDF was designed as an integrated planning and management tool to facilitate on-going sustainable development through the province.

### 4.3 LEGISLATIVE BAR CONTENT REQUIREMENTS

This document has been prepared in accordance with the DMR BAR template format, and was informed by the guidelines posted on the official DMR website. This is in accordance with the requirements of the MPRDA. This report also complies with the requirements of the NEMA and Appendix 2 and Appendix 4 of EIA Regulations 2014, as amended (GNR 982).

Table 4-3 provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

**TABLE 4-3: STRUCTURE OF THE BAR**

BAR requirement as per the DMR template	BAR requirements as per the 2014 NEMA regulations, as amended	Reference in the EMPr report
<b>Part A of DMR report template</b>	<b>Appendix 2 of the NEMA regulations, as amended</b>	<b>Section/Appendix</b>
Details of the EAP.	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 1.2 and Appendix B.
Location of overall activity.	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

BAR requirement as per the DMR template	BAR requirements as per the 2014 NEMA regulations, as amended	Reference in the EMP report
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 2.
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. A description of the activities to be undertaken, including associated structure and infrastructure.	Section 3.
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 5.
Motivation for the overall preferred site, activities and technology alternative.	A motivation of the preferred development footprint within the approved site including.	Section 5.3.
A full description of the process followed to reach the proposed development footprint within the site.	A full description of the process followed to reach the proposed development footprint within the approved site.	Section 7.
Details of the development footprint alternatives considered.	Details of all the alternatives considered.	Section 7.1.
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 7.2.
Summary of issues raised by I&APs.	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 7.3.
Environmental attributes associated with the alternatives.	The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	Section 7.4.
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 7.5.
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 7.6.
The positive and negative impacts that the proposed activity (in terms	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the	Section 7.7.

BAR requirement as per the DMR template	BAR requirements as per the 2014 NEMA regulations, as amended	Reference in the EMP report
of the initial site layout) and alternative will have on the environment and the community that may be affected.	community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	
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 7.8.
Motivation where no alternative sites were considered.	The outcome of the site selection matrix. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such.	Section 7.9.
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 7.10.
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 8.
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 9 and Appendix E.
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 0.
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 11.
Proposed impact management objectives and the impact management outcomes for inclusion	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact	Section 12.

BAR requirement as per the DMR template	BAR requirements as per the 2014 NEMA regulations, as amended	Reference in the EMP report
in the EMP.	management outcomes for the development for inclusion in the EMP.	
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
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.
Specific information required by the competent authority.	Any specific information required by the competent authority.	Section 19.
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 20.
<b>Part B of the DMR report template</b>	<b>Appendix 4 of the NEMA regulations</b>	<b>Section/Appendix</b>
Details of EAP.	Details of the EAP who prepared the EMP and the expertise of that EAP to prepare the EMP, including curriculum vitae.	Section 21.
Description of the aspects of the activity.	A detailed description of the aspects of the activity that are covered by the EMP as identified by the project description.	Section 22.
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 23.
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	Section 24.

BAR requirement as per the DMR template	BAR requirements as per the 2014 NEMA regulations, as amended	Reference in the EMP report
	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 24.1.
Impacts to be mitigated in their respective phases.	-	Section 24.4
Impact management outcomes.	A description and identification of impact management outcomes required for the aspects contemplated in paragraph.	Section 25
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 26.
Financial provision.		Section 1.
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 28.
	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 29.
Specific information required by the competent authority.	Any specific information that may be required by the competent authority.	Section 30.
Undertaking.	-	Section 31.



## 5 NEED AND DESIRABILITY OF THE PROJECT

The DEA guideline on need and desirability (GNR 891, 20 October 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. Thus, the overarching framework for considering the need and desirability of development in general is taken at the policy level through the identification and promotion of activities / industries / developments required by civil society as a whole. The DEA guideline further notes that at a project level (as part of an EIA process), the need and desirability of the project should take into consideration the content of regional and local plans, frameworks and strategies.

### 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. However the proposed WRD extension area is located centrally between the existing Tshipi and MMT mining operations in an area previously disturbed by mining related activities and infrastructure. The area is rated by the biodiversity specialist as having moderate-low sensitivity and may be disturbed with minimal mitigation. These areas together with low sensitivity areas are preferred for development (NSS, 2018). By extending the Sinterfontein WRD, the disturbance to biodiversity is minimised.

### 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) (May 2016) are mainly focused around the reduction of unemployment and halving poverty, as well as establishing affordable 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 SDF, 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; within which the mine is located (see Figure 9).

Given that the project forms part of existing approved operations and that the proposed extension to the WRD will not generate any additional employment opportunities, negative project-related socio-economic impacts including inward migration are not expected to occur. The economic benefits associated with mining the boundary pillar have previously been accounted for. The extension of the WRD is required to provide additional capacity to store waste rock that is generated as part of mining the boundary pillar. As a result the potential for increased economic benefits due to project activities is expected to be negligible.

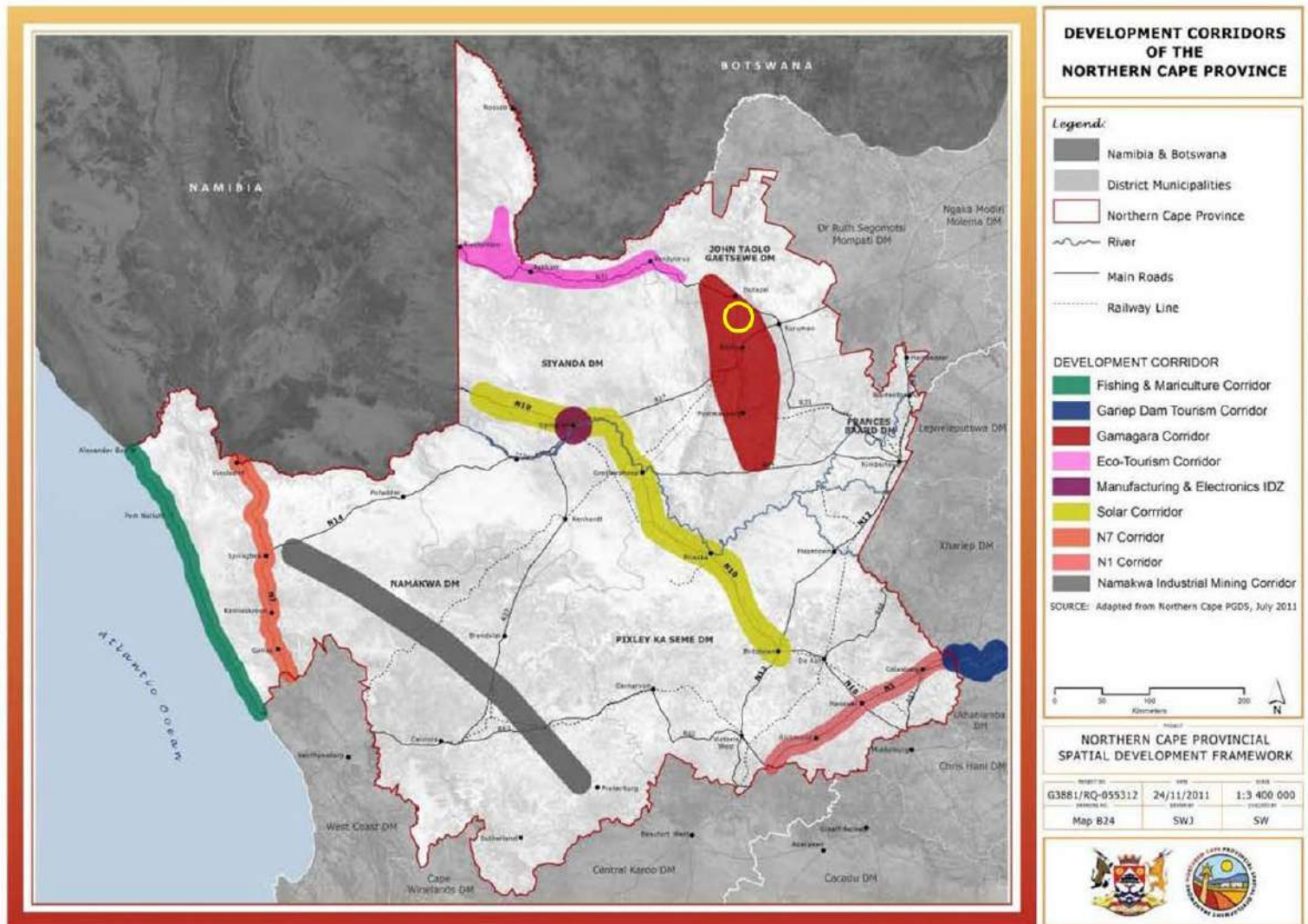


FIGURE 9: Mining right area (yellow circle) in relation to development regions and corridors of the Northern Cape (NPSDF, 2012)

### 5.3 RATIONALE FOR THE PROPOSED PROJECT ACTIVITY

As the MMT has developed it has become apparent to through long-term planning, that additional waste rock storage areas are needed to allow continued optimal operation of the mine.

## **6 MOTIVATION FOR THE PREFERRED SITE, ACTIVITIES AND TECHNOLOGY ALTERNATIVES**

No feasible alternatives exist for the proposed project and as such this section is not applicable. Refer to Section 7.1 for further detail.

## 7 FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED ALTERNATIVES WITHIN THE SITE

### 7.1 DETAILS OF THE DEVELOPMENT FOOTPRINT CONSIDERED

No feasible alternatives exist for the proposed project for the following reasons:

- The merging of the WRDs would disturb vegetation that has already been impacted by mining activities thereby minimising the mine's footprint and the need to impact on undisturbed areas within the mining right area.
- Undisturbed areas within MMT are earmarked for future infrastructure limiting the availability of space for additional waste rock storage.
- The merged WRD would allow for optimised haulage distance due to its location in close proximity to the open pit.
- Placing waste rock back into the open pit is not deemed feasible due to space limitation within the open pit. If waste rock was placed in the pit, there would be insufficient space within the open pit for mining activities to take place.

#### 7.1.1 THE "NO-GO" ALTERNATIVE

The "no-go" alternative would mean that the Sinterfontein WRD is not extended. This would restrict the mine's ability to realise the economic benefits associated with extracting the mineral resources from the barrier pillar. As discussed above, no other feasible alternatives exist for waste rock storage.

### 7.2 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

This section describes the public participation process undertaken during the BAR process. The public participation process was undertaken in accordance with the requirements of Chapter 6 of Regulations 982 of 4 December 2014 (EIA Regulations), as amended. In addition to this, consideration was also given to the public participation guideline in terms of the NEMA (2017).

#### 7.2.1 PUBLIC PARTICIPATION PROCESS UNDERTAKEN

A public participation process was undertaken to inform the BA process. A record of the public participation process undertaken is outlined in Table 7-1 below. The purpose of the public participation process was to notify landowners, land users and other key stakeholders of the proposed project and to provide them with opportunity to raise any initial issues or concerns regarding the proposed project.

**TABLE 7-1: PUBLIC PARTICIPATION PROCESS UNDERTAKEN AS PART OF THE BAR**

Step	Detail
DMR Pre-application meeting	A pre-application meeting was held with the DMR in Kimberly on 01 February 2019. The purpose of the meeting was: <ul style="list-style-type: none"><li>• To provide information pertaining to the proposed project</li></ul>

Step	Detail
	<ul style="list-style-type: none"> <li>• To outline the motivation for the proposed project</li> <li>• To outline the alternatives considered as part of the proposed project</li> <li>• To provide an overview of the environmental process relevant to the project</li> <li>• To provide an overview of the existing status of the environment</li> <li>• To outline and obtain input on the potential environmental/cultural impacts</li> <li>• To outline and obtain input on the planned public participation process.</li> </ul> <p>A copy of the pre-application meeting minutes is included in Appendix C.</p>
DWS pre-application liaison	<p>The DWS was contacted telephonically and via email liaison to discuss the proposed project. The purpose of the interaction with the DWS was:</p> <ul style="list-style-type: none"> <li>• To provide information pertaining to the proposed project.</li> <li>• To outline the motivation for the proposed project.</li> <li>• To outline the alternatives considered as part of the proposed project.</li> <li>• To provide an overview of the environmental process relevant to the project.</li> <li>• To provide an overview of the existing status of the environment.</li> <li>• To outline and obtain input on the potential environmental/cultural impacts.</li> <li>• To outline and obtain input on the planned public participation process.</li> </ul> <p>Refer to Appendix C for proof of consultation with the DWS.</p>
Environmental authorisation and waste management licence application	<p>Submission of this integrated NEMA environmental authorisation and NEM:WA waste management licence application to the DMR. Refer to Appendix C for a copy of the application form and the acknowledgement by the DMR.</p>
Notification of the land claims commissioner	<p>The land claims commissioner was consulted in order to verify if any land claims have been lodged on the farm Sinterfontein 748. The proof of correspondence is attached in Appendix C.</p>
Project database	<p>The existing database compiled for Tshipi was utilised and updated to be specific for the MMT BAR. Landowner, land user, commenting authorities and other I&amp;AP details were verified through telephonic discussions. A copy of the project database is included in Appendix C.</p>
Background Information Document (BID)	<p>A BID was compiled by SLR and distributed to I&amp;APs and commenting authorities registered on the project database. The BID provides:</p> <ul style="list-style-type: none"> <li>• Information about the proposed project.</li> <li>• Information about the baseline environment of the proposed project area.</li> <li>• Information about the environmental assessment process (Basic Assessment Process).</li> <li>• Information regarding possible environmental/cultural impacts.</li> <li>• Details pertaining to the public meeting.</li> <li>• Information on how I&amp;APs and commenting authorities can have input into the environmental assessment process.</li> </ul> <p>A registration and response form was attached to the BID, which provided I&amp;APs with an opportunity to register as an I&amp;AP and submit comments on the proposed project. Copies of the BID in English and Afrikaans are included in Appendix C.</p>
Site notices	<p>SLR placed laminated site notices (in English and Afrikaans) at key conspicuous positions in and</p>

Step	Detail
	<p>around the MMT, as well as in nearby towns. Photographic proof is included in Appendix C. A map illustrating the location of the site notices is also included in Appendix C.</p>
Newspaper advertisements	<p>Block advertisements were placed in the Kalahari Bulletin and the Kathu Gazette on 28 March 2019 and 30 March respectively. Copies of the adverts are included in Appendix C.</p>
Public meeting	<p>A public meeting was held on 16 April 2019. The purpose of the meeting was as follows:</p> <ul style="list-style-type: none"> <li>• To provide an overview of the proposed project</li> <li>• To provide an overview of the environmental assessment process that will be undertaken for the proposed project</li> <li>• To provide an overview and obtain input on the existing status of the environment</li> <li>• To outline and obtain input on environmental/cultural impacts identified for the proposed project</li> <li>• To record any comments and issues raised. These issues and concerns will be used to inform the Basic Assessment Report.</li> </ul> <p>A record of the meeting is included in Appendix C. It is important to note that there were no attendees at the public meeting.</p> <p><i>A second public meeting will be planned during the 30 day review period of the BAR. This is in line with recommendations made by the DMR at the pre-application meeting held on 01 February 2019 (see Appendix C).</i></p>
Commenting authority meeting	<p>A commenting authorities meeting was planned for 16 April 2019. The purpose of the meeting was as follows:</p> <ul style="list-style-type: none"> <li>• To provide an overview of the proposed project</li> <li>• To provide an overview of the environmental assessment process that will be undertaken for the proposed project</li> <li>• To provide an overview and obtain input on the existing status of the environment</li> <li>• To outline and obtain input on environmental/cultural impacts identified for the proposed project</li> <li>• To record any comments and issues raised. These issues and concerns will be used to inform the Basic Assessment Report.</li> </ul> <p>A record of the meeting is included in Appendix C.</p> <p><i>A second commenting authority meeting will be planned to take place during the 30 day review period of the BAR. This is in line with recommendations made by the DMR at the pre-application meeting held on 01 February 2019 (see Appendix C).</i></p>
Public review and commenting authority Review of Basic Assessment Report	<p>The Basic Assessment Report will be made available for public review and comment for 30 days. Summaries of the Basic Assessment Report will be made available to all I&amp;APs registered on the I&amp;AP database via email, fax and post. In addition, I&amp;APs will be notified when the Basic Assessment Report will be available for review via SMS. In addition to this, electronic copies will be made available on the SLR website.</p> <p>Commenting authorities will either receive an electronic copy or a hard copy of the Basic Assessment Report depending on the commenting authorities' preference.</p>

Step	Detail
	The Basic Assessment Report will be updated to include all comments received during the public review and commenting period. Comments will be recorded and responded to in a Comments and Response Report. This updated report will be submitted to the DMR for decision making purposes.
Following review of the Basic Assessment Report	The Basic Assessment Report will be updated to include all comment received during the review and commenting period. This updated report will be made available to the DMR for decision making purposes.



### 7.3 SUMMARY OF ISSUES RAISED BY I&APS

No comments and concerns have been received to date.

**TABLE 7-2: SUMMARY OF ISSUES RAISED BY I&APS**

Interested and affected party	Mark with an X if those who must be consulted were in fact consulted	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
<b>Regulatory authority</b>					
<b>Department of Mineral Resources (DMR)</b>					
Johannes Nematatani	X	Comment raised at the pre-application meeting held with the DMR in Kimberley on 01 February 2019.	The public participation process outlined in the presentation does not make provision for a public meeting. This needs to form part of the public participation process. In addition to this, the public meeting must take place after the submission of the application and during the review of the Basic Assessment Report.	A public meeting was held on 16 April 2019. It is however important to note that a second public meeting will be held during 30 day the review of the BAR by I&APs and commenting authorities.	Section 7.2.1 and Appendix C.
Ntsundeni Ravhugoni	X		South32 needs to ensure that the Mine Works Programme and the Environmental Management Programme are aligned.	Authorisation is required from the DMR in terms of Section 102 of the MPRDA to amend the existing EMP and mine works programme to take cognisance of the proposed project. MMT will apply for a Section 102 Amendment in terms of the MPRDA. This EIR will support this application.	Section 4.1 and Table 4-1.
Ntsundeni Ravhugoni	X		Due to the nature of the project and the close working relationship between the MMT and Tshipi, the DMR	Noted.	Not applicable.

Interested and affected party	Mark with an X if those who must be consulted were in fact consulted	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			may investigate the viability of granting one authorisation for both South32 and Tshipi.		
Takalani Khorombi	X		Why does the waste rock need to be stored on surface and not backfilled into the pit?	Placing waste rock back into the open pit is not deemed feasible due to space limitation within the open pit. If waste rock was placed in the pit, there would be insufficient space within the open pit for mining activities to take place. This was considered as part of the alternatives for the project as outlined in Section 7.1.	Section 7.1
<b>Commenting authorities</b>					
<b>Local Municipality – Ward 4</b>					
Councillor Katong	X	16 April 2019, raised at the commenting authorities meeting	Have the necessary licences for the project have been issued.	No authorisations have currently been issued by the DMR or DWS. The proposed project triggers various activities for which authorisation is required in terms of the NEMA, NEM:WA and NWA. A BAR is required in order for the DMR to consider the application for NEMA/NEM:WA environmental authorisation. A separate report (Integrated Water and Waste Management Plan and supporting water use forms), will be submitted to the DWS in order for their department to consider the application in terms of the NWA.	Section 3.1 and Section 4
<b>Department of Forestry and Fisheries</b>					
Jacoline Mans	X	Comment	Protected trees such as <i>Vachelle erioloba</i> , <i>Vachellia</i>	A biodiversity study was completed for the MMT in	Section 4 and Section

Interested and affected party	Mark with an X if those who must be consulted were in fact consulted	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
		received on 15 April 2019	<p><i>Haematoxylon</i> and <i>Bascia albitrunca</i> can be found in the study area. It is unlikely the impact would be significant by merging the 18m wide void between the two waste rock dumps, because the area has already been impacted by mining activities. In the event that protected trees are encountered, the mines must apply for a Forest Act Licence prior to disturbance of trees.</p> <p>Provincially protected plants are known to occur in the vicinity of the study site and may not be damaged, disturbed or relocated without a valid Flora Permit from the provincial Department of Environment and Nature Conservation, under the Northern Cape Nature Conservation Act, No. 9 of 2009, if affected.</p> <p>Trees with birds nest may not be disturbed without a valid Fauna Permit from Nature Conservation, under the Northern Cape Nature Conservation Act, No. 9 of 2009.</p> <p>Getting a Forest Act Licence can take up to 30 days. Licence application forms are available on the Departmental website or at only Forestry Office. The</p>	<p>2018. This study indicated that there are no protected trees or plants located within the proposed project area. However, the mitigation actions outlined in this report (Section 26), commit MMT to obtain the necessary licences (Tree permits from DAFF and plant permits from DENC), if any protected species are encountered. In addition to this, if any active bird nests are identified within the proposed project area that need to be disturbed, the necessary permits will be obtained from the DENC.</p>	26.

Interested and affected party	Mark with an X if those who must be consulted were in fact consulted	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			<p>Department may ask for supporting documentation when assessing a licence application. For construction activities of this nature, the following supporting documents are normally requested:</p> <ul style="list-style-type: none"> <li>• Completed Licence Application Form</li> <li>• Accurate estimation of the number of trees to be felled per species</li> <li>• Copy of ID</li> <li>• Copy of Environmental Authorisation</li> <li>• Flora Permit Reference number</li> <li>• Copy of Fauna Permit (if applicable).</li> </ul>		
<b>Interested Parties</b>					
Ravete Tshifyiwa	X	Comment received via comment sheet submitted on 04 April 2019	There are no objections to the project at all; I am just interested in knowing more about the visual impact and air pollution that might emanate from this project.	In terms of the visual impact; the visual landscape within the MMT area has been transformed due to the presence of approved mining infrastructure and activities. The proposed WRD extension area is located centrally between the current Tshipi Borwa Mine and the MMT mining activities and is therefore not expected to influence existing negative visual impacts. The WRD extension would be absorbed into current views of the mining activities. At closure the WRD extension would be rehabilitated in line with the mine's rehabilitation and closure plan which makes provision for a final land use	Appendix E

Interested and affected party	Mark with an X if those who must be consulted were in fact consulted	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
				<p>of wilderness This impact has therefore been rated as being INSIGNIFICANT.</p> <p>In terms of air pollution, the main contaminants associated with the proposed project includes: inhalable particulate matter less than 10 microns in size (PM10) (including a manganese component) and larger total suspended particulates (TSP) that relate to dust fallout. The inhalable components can cause human health impacts at high concentrations over extended periods, while the larger particulate component can cause nuisance dust impacts such as soiling of grazing veld at high fallout quantities over extended periods. 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.</p> <p>During all project phases dust will be generated by activities associated with the extension of the WRD. The advantage of the WRD from an air quality perspective is that the footprint is small (approximately 4 ha), and that it is shielded by the existing Tshipi Eastern WRD to the west and the existing Mamatwan WRD to the east. The</p>	

Interested and affected party	Mark with an X if those who must be consulted were in fact consulted	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
				<p>Tshipi Eastern WRD should act as a wind barrier from the stronger westerly winds, and to some extent from the northerly winds. The filling of waste rock into the void instead of tipping at the crest of the WRD, would also reduce potential impacts. At decommissioning, truck activity, tipping of topsoil and levelling out of the exposed side slopes during rehabilitation might result in significant dust generation. Taking this into account, the increase in ground level concentrations for PM10 or PM2.5 and dust fallout off-site is rated as having a low significance in the mitigated and unmitigated scenarios.</p>	

## 7.4 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES

An understanding of the environmental and social context and sensitivity within which the proposed project activities are being located is important to understanding the potential impacts. This section provides a description of the attributes of the biophysical and socio-economic receiving environment of the project area.

It is important to note that Tshipi has commenced with their EMP amendment process to cater for the merging of the WRDs. As part of the Tshipi EMP amendment process, specialist studies were undertaken to inform the baseline environment. The majority of the specialist studies undertaken as part of the Tshipi EMP amendment process also cater for the proposed project footprint area. For the proposed project, reference will be made to specialist studies undertaken by Tshipi that adequately cater for the proposed project area.

Where specialist studies have been completed for MMT and are of relevance to the proposed project footprint area, these have been referenced in this section. Where relevant, specialist studies have been included as an attachment to the BAR.

### 7.4.1 BASELINE ENVIRONMENT AFFECTED BY THE PROPOSED ACTIVITY

#### 7.4.1.1 GEOLOGY

##### INTRODUCTION AND LINK TO IMPACT

Geology and associated structural features provide 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 (Sinterfontein WRD); 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 7.4.1.4) and the potential for palaeontological resources (see Section 7.4.1.12).

##### DATA SOURCES

Information in this section was sourced from groundwater studies completed for the adjacent Tshipi Borwa Mine (SLR, 2017; SLR, 2018), the updated groundwater study completed for MMT in 2018 (GHT, 2018) and the geochemical assessment completed for the adjacent Tshipi Borwa Mine (SLR, 2014). Given that MMT is located adjacent to the Tshipi Borwa Mine, the baseline conditions as presented in the Tshipi specialist studies also apply to MMT.

For the geochemical assessment, samples of different lithologies were taken from the Tshipi Borwa open pit for the geochemical analysis of waste rock material.

**DESCRIPTION**

**Regional geology**

The world’s largest land based sedimentary manganese deposit is contained in the Kalahari Manganese Field, situated 47 km north-west of Kuruman in the Northern Cape. The general stratigraphic column of the Kalahari Manganese Field is included in Table 7-3 below (SLR, 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 MMT is located in the Hotazel Formation (Transvaal Supergroup) towards the southern end of the Kalahari Basin. 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 – the so called banded iron formations.

**TABLE 7-3: GENERAL STRATIGRAPHIC COLUMN FOR THE KALAHARI MANGANESE FIELD (SLR, 2017)**

Supergroup / Group / Subgroup / Formation		Geological Description		
Kalahari Group		Kalahari sands, calcrete, clays & gravel beds		
<i>Kalahari unconformity</i>				
Karoo Supergroup		Dwyka tillite		
<i>Dwyka unconformity</i>				
Olifantshoek Supergroup	Lucknow Formation	White ortho-quartzite		
	Mapedi Formation	Green, maroon and black shales and quartzites		
<i>Olifantshoek unconformity</i>				
Transvaal Supergroup	Postmansburg Group	Voelwater Subgroup	Moodraai Formation	Dolomite, Chert
			Hotazel Formation	Banded ironstone (upper)
				Upper Manganese Ore Body
				Banded Ironstone (middle)
				Middle Manganese Ore Body
				Banded Ironstone (middle)
				Lower Manganese Ore Body
				Banded Ironstone (lower)
	Ongeluk Formation	Andesitic Lava		

**Local and operational geology**

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 7-3 (SLR, 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 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. This consists of tillite (diamictite), which is covered by sands, claystone and calcrete of the Kalahari Group (SLR, 2017).

MMT is exploiting the manganese from the banded iron stones of the Hotazel Formation. The ore is contained within a 30 to 45 m thick mineralised zone which occurs along the entire extent of MMT and is made up of three manganese rich zones, namely the Upper Manganese Ore Body (UMO), the Middle Manganese Ore Body (MMO) and the Lower Manganese Ore Body (LMO) (see Table 7-3). The UMO is 10 cm to 15 cm thick and comprises moderate deposits of manganese. The poorly mineralised MMO is approximately 1 m thick and not economically viable. The LMO is highly mineralised and makes up the bulk of the ore body. The ore layer dips gradually to the north-west at approximately five degrees (SLR, 2017).

### ***Faults and dykes***

No significant faults, fractures or other lineaments have been identified on site (SLR, 2019).

### ***Geochemistry analysis – Acid base accounting (ABA)***

Acid base accounting (ABA) is undertaken to determine the potential for mined material to generate acid mine drainage. The ABA results show that the total sulphur content and more importantly the sulphide sulphur content are below the laboratory detection limit of <0.01% which suggests the potential to generate acid is negligible for waste rock. In addition, the neutralising potential ratio (NPR) 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, 2014).

### ***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. The tests indicate that arsenic (As) and barium (Ba) may leach at concentrations above the SANS 241 (2015) Chronic Health Standards. Elevated concentrations of iron (Fe) and manganese (Mn) were recorded in a number of leachates above the SANS 241 (2015) Aesthetic standards. The nitrate (N) in the calcrete sample was above the SANS 241 (2015) Acute Health Standard (SLR, 2014).

## **CONCLUSION**

Where mineralised waste is produced by a project, there is the possibility that sterilisation can occur depending on the project design and placement of infrastructure. Geochemical analysis indicates that the potential to generate acid is negligible. Leachate at source could exceed the SANS 241 (2015) Drinking water standards for certain contaminants, and 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 with respect to the WRD extension.

## 7.4.1.2 TOPOGRAPHY

### INTRODUCTION AND LINK TO IMPACT

The planned extension of the WRD will alter the natural topography of the project area. This in turn may impact on surface water drainage (discussed in Section 7.4.1.6) and visual aspects (discussed in Section 7.4.1.10).

### DATA SOURCES

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

### DESCRIPTION

In general the area surrounding the MMT is relatively flat with a gentle slope towards the north-west. The elevation varies from 1 087 m to 1 107 m above mean sea level (mamsl). The Vlermuisleegte River is located approximately 3 km west and the Witleegte River is located approximately 6 km northeast of the proposed project site. The natural topography of the area surrounding the MMT has been influenced largely through mining activities such as the Tshipi Borwa Mine, the old Middelpaats Mine, the United Manganese of Kalahari Mine and the Adams Solar Farm. The highest topographical features near the MMT are the Tshipi Borwa Mine WRDs located adjacent to the western boundary of the MMT (see Figure 2).

The majority of the natural topography at the MMT has been disturbed as a result of the existing mining infrastructure and activities. The topography of the undisturbed WRD void is relatively flat.

### CONCLUSION

While the topography of the MMT has been altered by mining and associated infrastructure, the proposed WRD extension has the potential to alter the topography and the natural state of undisturbed areas.

## 7.4.1.3 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.

### DATA SOURCES

Information in this section was sourced from a review of available literature undertaken for the adjacent Tshipi Borwa Mine (Airshed, 2018a and SLR, 2018). Given that MMT is located adjacent to the Tshipi Borwa Mine, the baseline conditions as presented in the specialist studies also apply to the MMT.

## DESCRIPTION

### **Regional climate**

The project area falls within the Northern Steppe Climatic Zone, as defined by the South African Weather Bureau. This is a semi-arid region characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter (SLR, 2018).

### **Rainfall, rainfall depths and evaporation**

Monthly rainfall and evaporation data for the Milner weather station (approximately 7 km to the east of the MMT) is summarised in Table 7-4 below (SLR, 2018). Rainfall depth frequency data is summarised in Table 7-5 below.

With reference to Table 7-4 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 MMT, similar rainfall levels can be expected at the mine. The average evaporation rates recorded at the Milner weather station are 2 351 mm per annum for S-Pan and 1 972 mm per annum for open water (see Table 7-4).

**TABLE 7-4: SUMMARY OF AVERAGE MONTHLY AND ANNUAL RAINFALL AND EVAPORATION DATA (SLR, 2018)**

Month	Rainfall (mm)	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
<b>Annual</b>	<b>372.0</b>	<b>2351.0</b>	<b>1972.0</b>

**TABLE 7-5: RAINFALL DEPTH FREQUENCY (SLR, 2018)**

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

Storm Duration (m/h/d)	Return Period (years)						
	2	5	10	20	50	100	200
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
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 7-6 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, 2018a).

**TABLE 7-6: MONTHLY TEMPERATURE DATA (AIRSHED, 2017A)**

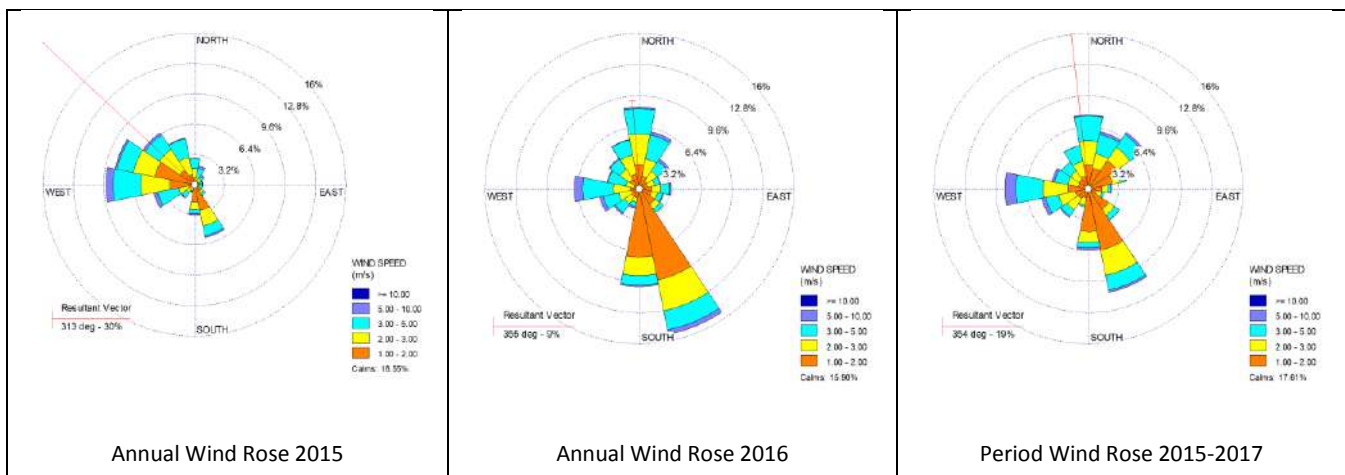
Months	Minimum	Maximum	Average
January	15.3	35.0	26.4
February	14.1	34.1	25.8
March	10.1	32.5	24.5
April	4.4	29.9	18.7
May	2.4	26.9	15.4
June	-0.6	22.3	10.8
July	1.0	21.7	11.4
August	0.4	28.3	13.1
September	2.1	27.8	16.8
October	6.7	32.3	20.5
November	8.8	34.7	23.3
December	11.9	35.0	25.2

**Wind**

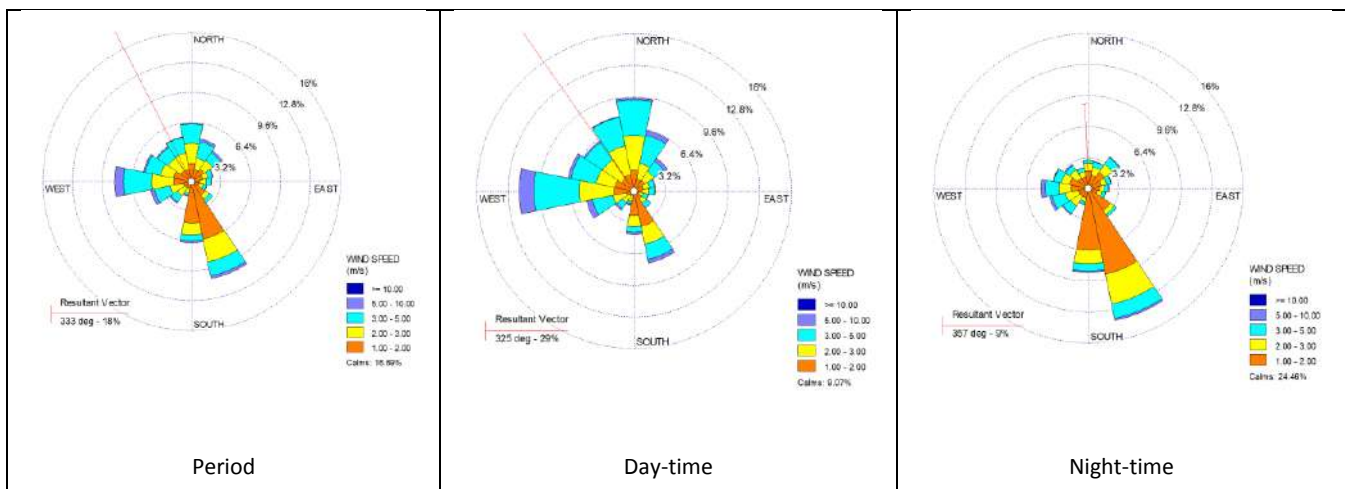
The annual average wind roses for the Kuruman Weather Station (located approximately 43 km to the west of MMT) for the years 2015, 2016 and 2017 are shown in Figure 10 with the period average wind field (2015-2017) and diurnal variability in the wind field provided in Figure 11. The predominant wind direction is from the

south-south-east and south with most of strong winds from the west. Frequent winds also occur from the north. Over the three-year period (2015 – 2017), the frequency of occurrence of south-south-easterly wind was between 12% and 17%, with winds with a westerly component occurring approximately 15% of the time. Winds occur less frequently from the easterly sector (Airshed, 2018a). During the day winds are more frequent from the westerly and the northerly sectors, with the strongest winds directly from the west (see Figure 11). The wind shifts during the night-time to dominantly south-south-easterly and southerly winds. Day-time calms occurred for 9% of the time, with night-time calms for 24% of the time (Airshed, 2018a).

According to the Beaufort wind force scale, wind speeds between 6-8 m/s equates to a moderate breeze, with wind speeds between 14-17 m/s near gale force winds. Based on the three years of SAWS data (2015-2017), wind speeds exceeding 6 m/s occurred for only 1% of the time, with a maximum wind speed of 10 m/s. The average wind speed over the three years was 2.06 m/s. Calm conditions (wind speeds < 1 m/s) occurred for 17% of the time. The US EPA indicates a friction velocity of 5.4 m/s to initiate erosion from a coal storage piles (US EPA, 2006). Thus, the likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. Wind speeds exceeding 5.4 m/s occurred only for 2% over the three years (2015 -2017) (Airshed, 2018a).



**FIGURE 10: PERIOD AND ANNUAL WIND ROSES (SAWS KURUMAN DATA; 2015, 2016 AND 2017)**



**FIGURE 11: PERIOD, DAY-TIME AND NIGH-TIME WIND ROSES (SAWS KURUMAN DATA; 2015 TO 2017)**

### **Atmospheric Stability**

During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the predominance of an unstable layer. During unstable conditions, ground level pollution is readily dispersed thereby reducing ground level concentrations. Night-times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds and less dilution potential. During windy and/or cloudy conditions, the atmosphere is normally neutral (which causes sound scattering in the presence of mechanical turbulence).

For low level releases, such as activities associated with mining operations, the highest ground level concentrations would occur during weak wind speeds and stable (night-time) atmospheric conditions. However, windblown dust is likely to occur under high winds (neutral conditions).

### **CONCLUSION**

The project area is characterised by hot to very hot summers and cool to warm winters with rain generally occurring in the form of localised thunderstorms that last for short periods at a time during rainy periods (October to April). 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. Wind significantly affects the amount of material that is suspended from exposed surface and wind speed determines the distance of downward transport as well as the rate of dilution of pollutants in the atmosphere. The likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. These climatic aspects need to be taken into consideration during operations, rehabilitation and surface water management planning.

#### **7.4.1.4 SOILS AND LAND CAPABILITY**

##### **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.

##### **DATA SOURCES**

Information in this section was sourced from the soil, land use and land capability study undertaken for the adjacent Tshipi Borwa Mine (Terra Africa, 2018). Given that the MMT is located adjacent to the Tshipi Borwa Mine, the baseline conditions as presented in the specialist study also apply to the MMT.

## DESCRIPTION

### ***Soil classification***

The soil forms identified within the study area is Witbank (Figure 12). This is an anthropogenic soil form that is characterised by soils that have undergone physical, chemical and hydrological impacts to the extent that land use options, as well as performance of vegetation that they support, are strongly and often permanently affected.

### ***Soil chemical characteristics***

The pH levels of soil in the study area range between 4.74 (strongly acid) and 6.21 (slightly acid). The soil pH levels do not pose a risk to plant growth and will not inhibit rehabilitation success. The phosphorus levels are as low as expected for natural veld conditions in South Africa. At lower pH levels, phosphorus becomes unavailable for uptake by plant roots. The cation levels (calcium, magnesium and potassium) indicate natural low soil fertility in the area as a result of the low cation exchange capacity. The cation complex is dominated by calcium, followed by magnesium and then potassium. Sodium levels are very low and do not pose a risk of causing sodic soils. The organic carbon content is very low and ranges between 0.22 and 0.26% (Terra Africa, 2017).

### ***Agricultural potential***

The proposed project area does not have any dryland agricultural or irrigation potential. The proposed project area does have some grazing potential. In this regard the area is suitable for small grazers and browsers such as goats or sheep although the area is most suitable for cattle production.

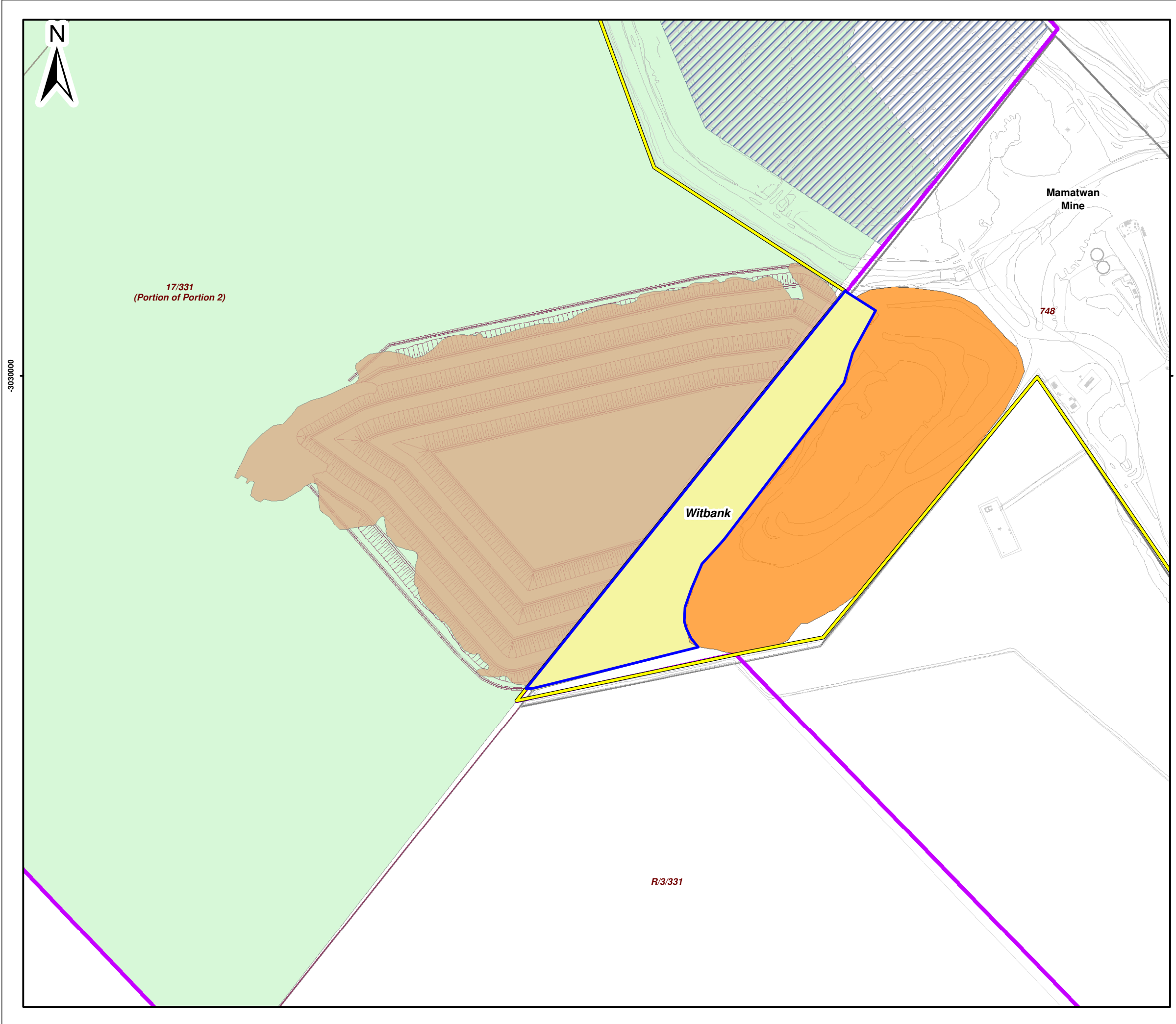
### ***Land capability***

The Witbank soil form has wilderness land capability potential. Wilderness land capability is classified as not having wetland, arable land or grazing land use potential.

## CONCLUSION

The soil form located in the proposed project area is a well-drained sandy soil, which allows for high infiltration rates and low organic content and is highly erodible. The soil fertility is low due to a deficiency in key nutrients, such as phosphorus. In general, the soil form located in the proposed project area has limited agricultural potential but is highly suitable for stripping and stockpiling for rehabilitation purposes.

Soil resources in the proposed project area have already been influenced by existing MMT waste rock disposal activities. The extension of the Sinterfontein WRD has the potential to further compromise soil resources through erosion, compaction and/or pollution and the natural capability of the land through an increased WRD footprint area. Appropriate management actions to prevent the loss of soil resources through pollution, compaction and erosion and related loss of land capability will need to be taken into consideration.



- Legend**
- Final Merged Waste Rock Dump
  - Sinterfontein Waste Rock Dump Void
  - Mamatwan Mining Right Area
  - Mamatwan Sinterfontein Waste Rock Dump
  - Tshipi Eastern Waste Rock Dump
  - Tshipi Surface Use Area
  - Tshipi Mining Right Area
  - ▨ Boundary Pillar
  - Farm Boundaries
  - Farm Portions
  - Soil Type

0 100 200 Meters  
 Scale: 1:7 500 @ A3  
 Projection: Transverse Mercator  
 Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 12**  
**Soil Map (Terra Africa, 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



## 7.4.1.5 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 relate to soil formation and fertility maintenance; primary production through photosynthesis; 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 extension of the WRD has 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 vegetation types 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 biodiversity study completed for MMT in 2018 (NSS, 2018).

### DESCRIPTION

#### **Conservation characteristics**

Data accessed as part of the desktop assessment indicates that the project area does not fall within any protected or priority areas (see Table 7-7). This table also describes the vegetation type, Kathu Bushveld, and the dominant species of this vegetation type in the project area.

#### **Terrestrial habitat units**

On a broad level, all natural vegetation within the study area is seen as *Acacia* Thornveld and is considered an open savanna. The extension of the WRD would take place within the Disturbed *Acacia* Thornveld and more specifically the Dense *Acacia mellifera* Thornveld (Figure 13). The Dense *Acacia mellifera* Thornveld is a sparse grass layer, with the shrub layer dominated by *Acacia (Senegalia) mellifera*. Due to the prevailing wind conditions, this vegetation community receives a significant amount of manganese (Mn) dust. This vegetation community is located adjacent to and between existing mining operations of both Mamatwan and Tshipi Borwa Mine. The condition of the veld has been influenced by this which is evident by the numerous dead *A mellifera* and *Grewia* shrubs. Studies have shown that the accumulation of excessive Mn in leaves causes a reduction of photosynthetic rate (NSS, 2018).

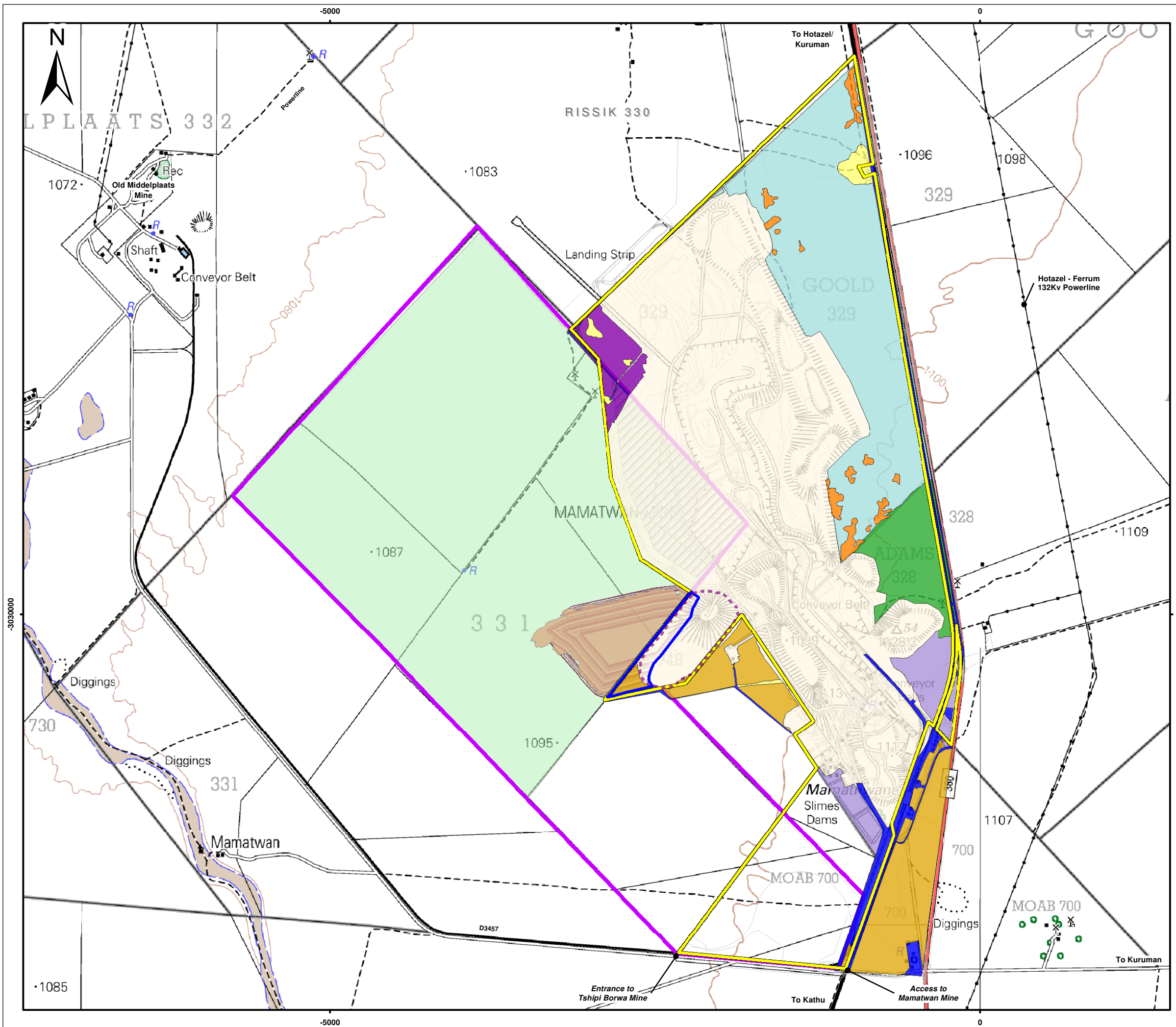
#### **Floral species of conservation concern**

During field investigations, NSS identified within the study area three species of known conservation significance. These included *Acacia (Vachellia) erioloba*, *A. haematoxylon* and *Boopbone disticha*. None of these were noted in the area where the WRD extension is proposed (NSS, 2018). Plants that contain medicinal or cultural uses are also considered species with conservation importance and may occur within the proposed WRD extension area.

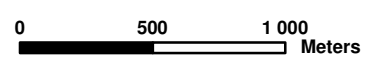
**TABLE 7-7: SUMMARY OF THE CONSERVATION CHARACTERISTICS OF THE STUDY AREA**

Details of the project area in terms of Mucina & Rutherford (2006)		Description of Kathu Bushveld (Mucina & Rutherford 2006)	
<b>Biome</b>	Savanna Biome.	<b>Vegetation &amp; landscape features</b>	Medium-tall tree layer with <i>Vachellia erioloba</i> in places, but mostly open and including <i>Boscia albitrunca</i> as prominent trees. Shrub layer generally most important with e.g. <i>Acacia mellifera</i> , <i>Diospyros lycioides</i> and <i>Lycium hirsutum</i> . Grass layer variable in cover.
<b>Bioregion</b>	Eastern Kalahari Bushveld Bioregion.		
<b>Vegetation Type</b>	Kathu Bushveld.		
<b>Conservation</b>	Least threatened. Target 16%. None conserved in statutory	<b>Tall Tree</b>	<i>Vachellia erioloba</i>
<b>Conservation details (Various databases)</b>		<b>Small Trees</b>	<i>Senegalia mellifera</i> subsp. <i>detinen</i> , <i>Boscia albitrunca</i> , <i>Terminalia sericea</i>
<b>NBA (2011)</b>	Currently not protected.	<b>Tall Shrubs</b>	<i>Diospyros lycioides</i> subsp. <i>lycioides</i> , <i>Dichrostachys cinerea</i> , <i>Grewia flava</i> , <i>Gymnosporia buxifolia</i> , <i>Rhigozum brevispinosum</i>
<b>National Threatened Ecosystems (2011)</b>	Not located in any threatened ecosystems	<b>Low Shrubs</b>	<i>Aptosimum decumbens</i> , <i>Grewia retinervis</i> , <i>Nolletia arenosa</i> , <i>Sida cordifolia</i> , <i>Tragia dioica</i>
<b>NPAES (2009), SACAD (2017) &amp; SAPAD (2017)</b>	Not located within a 10km radius of protected or conservation areas or area earmarked for expansion.	<b>Graminoids</b>	<i>Aristida meridionalis</i> , <i>Brachiaria nigropedata</i> , <i>Centropodia glauca</i> , <i>Eragrostis lehmanniana</i> , <i>Schmidtia pappophoroides</i> , <i>Stipagrostis ciliate</i> , <i>Aristida congesta</i> , <i>Eragrostis biflora</i> , <i>E. chloromelas</i> , <i>E. heteromera</i> , <i>E. pallens</i> , <i>Melinis repens</i> , <i>Schmidtia kalahariensis</i> , <i>Stipagrostis uniplumis</i> , <i>Tragus berteronianus</i>
<b>IBA (2015)</b>	Not located within 10 km of IBA.		
<b>Mining and Biodiversity Guidelines (2013)</b>		<b>Herbs</b>	<i>Acrotome inflata</i> , <i>Erlangea misera</i> , <i>Gisekia Africana</i> , <i>Heliotropium ciliatum</i> , <i>Hermbstaedtia fleckii</i> , <i>H. odorata</i> , <i>Limeum fenestratum</i> , <i>L. viscosum</i> , <i>Lotononis platycarpa</i> , <i>Senna italica</i> subsp. <i>Arachoides</i> , <i>Tribulus terrestris</i>
According to the Mining and Biodiversity guidelines, the project area is not ranked as a priority area, nor is it located near (within 10 km) an area considered to be of biodiversity importance.			
<b>Northern Cape Critical Biodiversity Areas (2016)</b>		<b>National Freshwater Ecosystem Priority Areas (NFEP, 2011)</b>	
No Critical Biodiversity Area (CBA) or Ecological Support Area (ESA) in Mamatwan. The Ga-Mogara, Vlermuisleegte and Witleegte rivers represent provincial Ecological Support Area (ESAs). The Vlermuisleegte River is located approximately 3 km to the west of the proposed West WRD extension area. An Ecological Support Area is considered important as these areas are associated with high diversity and topographic diversity.		No Category 1 River or Wetland FEPA on or within 500m of Mamatwan. The MMT is classified as an Upstream Management Area, which is a sub-quaternary catchment in which human activities need to be managed to prevent degradation of downstream river Freshwater Ecosystem Priority Areas and Fish Support Areas.	
<b>Northern Cape Provincial Spatial Development Framework (NCPSDF, 2012)</b>			
Within the Griqualand West Centre of Endemism and within the Gamagara Development Corridor. The corridor focuses on the mining of iron and manganese.			

**NBA = National Biodiversity Assessment; NPAES = National Protected Areas Expansion Strategy; SAPAD = South African Protected Areas Database; IBA = Important Bird Area**



- Legend**
- Final Merged Waste Rock Dump
  - Sinterfontein Waste Rock Dump Void
  - Mamatwan Mining Right Area
  - Mamatwan Sinterfontein Waste Rock Dump
  - Tshipi Eastern Waste Rock Dump
  - Boundary Pillar
  - Tshipi Surface Use Area
  - Tshipi Mining Right Area
  - Main Roads
  - Power Line
  - Rivers and Streams
  - 20m Contour Lines
- Vegetation Communities**
- Acacia mellifera clumps
  - Infrastructure
  - Disturbed Patches
  - Vegetation in Recovery
  - Mining
  - Dense Acacia mellifera Thornveld
  - A haematoxylon - G flava Thornveld
  - A mellifera - Stipagrostis Open Thornveld
  - A mellifera - A haematoxylon - G flava Thornveld



Scale: 1:28 500 @ A3  
 Projection: Transverse Mercator  
 Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 13**  
**Vegetation Communities at Mamatwan Mine (NSS, 2018)**

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### **Floral alien invasive species**

Alien, especially invasive plant species are a major threat to the ecological functioning of natural systems and to the productive use of land. Alien species are present at the mine but mainly within disturbed areas where soils have been exposed or where mining related activities occur. Over 15 species were recorded with 5 species listed as Category 1b invasive. *Argemone ochroleuca* and *Datura ferox* dominated cleared areas, *Alternanthera pungens* and *Verbesina encelioides* were mainly found in the shade of larger trees and *Nicotiana glauca* and *Pennisetum setaceum* on the mine dumps and stockpiles (NSS, 2018).

### **Faunal species of conservation concern**

Conservation Important (CI) mammal species may occur (at least occasionally) in or near MMT. Of greatest conservation concern is the globally Vulnerable (VU) Leopard. MMT staff previously reported to NSS (2013) that a Leopard was seen to frequent water near the Mine Crusher. Whether this species was and is still present on site is uncertain. The nationally Protected Bat-eared Fox and regionally Near Threatened (NT) Dent's Horseshoe Bat is rated with a high likelihood of occurrence (LO) in MMT. The nationally Protected Cape Fox and the regionally NT Southern African Hedgehog are also considered highly likely to occur as habitat conditions in Mamatwan are highly suitable for these species. The CITES listed Aardwolf, globally VU Black-footed Cat and regionally NT Honey Badger were rated with a moderate LO given their possible greater risk of disturbance from mining activities, people, traffic, etc. The Striped Pole-cat, which is listed as a Specially Protected Species in the Northern Cape was rated with a moderate LO in Mamatwan (NSS, 2018).

Four conservation important (CI) bird species were recorded in Mamatwan during 2018. These include the African Rock Pipit (*Anthus crenatus*), a regional near threatened species, as well as the Pale Chanting-goshawk (*Melierax canorus*), Black-chested Snake Eagle (*Circaetus pectoralis*) and Greater Kestrel (*Falco rupicoloides*) listed as being Specially Protected in the Northern Cape. The Kori Bustard is nationally protected and listed globally as near threatened (NSS, 2018).

None of the reptile species listed for Mamatwan has a global and/or regional threatened or protected status. The potentially occurring Common Flap-neck Chameleon and the Southern African Python are, however, listed as Specially Protected Species in the Northern Cape. The Common Flap-neck Chameleon is considered highly likely to occur, but the Southern African Rock Python is considered unlikely to occur in Mamatwan given: i) the extensive transformation of the site; ii) the extent of fencing in and around the mine; and iii) that this large, conspicuous species has to date not yet been encountered by anyone. The regionally NT Giant Bullfrog is unlikely to occur due to the lack of suitable aquatic habitat for this species on site (NSS, 2018).

None of the butterfly or odonatan species listed for MMT have a threatened or protected status (NSS, 2018).

Although none of the scorpion species listed for MMT has a global and/or regional threatened or protected status, all *Opisthophthalmus* (as well as *Opistacanthus* and *Hadogenes*) scorpion species are listed as Specially Protected Species in the Northern Cape (NSS, 2018).

**Local Areas of Conservation Significance**

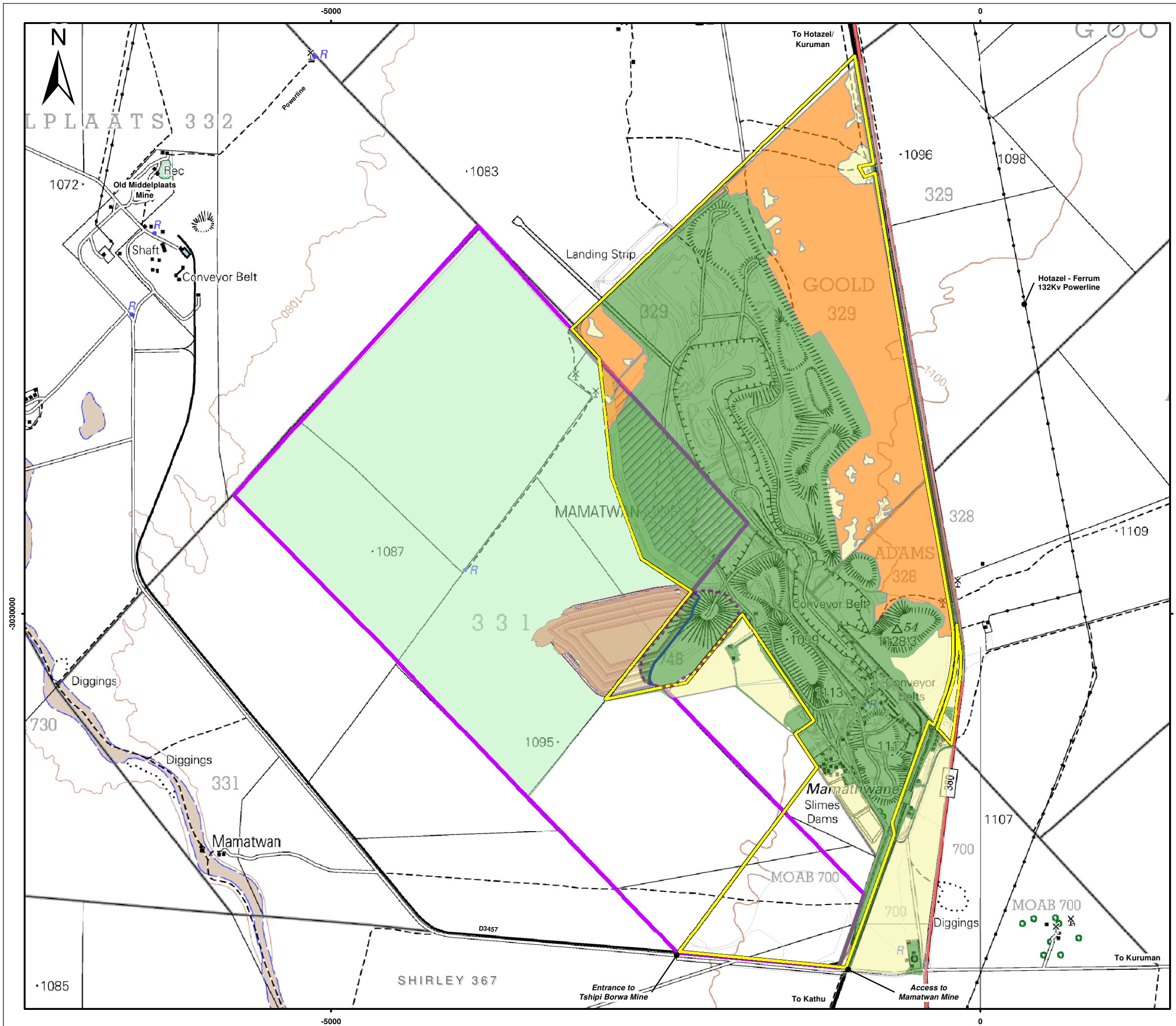
The relative conservation significance of local biodiversity was rated and mapped by NSS based on ecological sensitivity (including renewability/success for rehabilitation), level/extent of disturbance, presence of CI species (identified at the vegetation unit/habitat level) and conservation value (at a regional, national, provincial and local scale). Photographs depicting the status of the vegetation within the proposed WRD extension area are presented in Figure 14. The proposed WRD extension area is located in an area rated by NSS as having moderate-low sensitivity (Figure 15). Moderate-low sensitive areas may be disturbed with minimal mitigation and these areas together with low sensitivity areas are preferred for development (NSS, 2018).



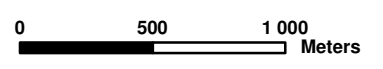
**FIGURE 14: PHOTOGRAPHS DEPICTING THE PROPOSED EXTENDED WRD FOOTPRINT AREA**

**CONCLUSION**

Although the proposed WRD extension has the potential to further disturb vegetation, habitat units and related ecosystem functionality, the proposed footprint is located within an area rated to have a moderate-low sensitivity. From a biodiversity perspective moderate-low sensitive areas may be disturbed with minimal mitigation.



- Legend**
- Final Merged Waste Rock Dump
  - Sinterfontein Waste Rock Dump Void
  - Mamatwan Mining Right Area
  - Mamatwan Sinterfontein Waste Rock Dump
  - Tshipi Eastern Waste Rock Dump
  - ▨ Boundary Pillar
  - Tshipi Surface Use Area
  - Tshipi Mining Right Area
  - Main Roads
  - Power Line
  - Rivers and Streams
  - 20m Contour Lines
- Sensitive Areas**
- Medium
  - Medium-Low
  - Low



Scale: 1:28 500 @ A3  
 Projection: Transverse Mercator  
 Datum: WGS1984, Lo23

**Mamatwan Mine**

**Figure 15**  
**Areas of Concern and Sensitivity**  
**At Mamatwan Mine (NSS, 2018)**



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## 7.4.1.6 SURFACE WATER

### INTRODUCTION AND LINK TO IMPACT

Surface water resources include drainage patterns and paths of preferential flow of storm water runoff. Project-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 runoff from mineralised waste stockpiles.

### DATA SOURCES

Information in this section was sourced from hydrology study completed for the adjacent Tshipi Borwa Mine (SLR, 2018a). Given that MMT is located adjacent to the Tshipi Borwa Mine, the baseline conditions as presented in the specialist study also apply to the MMT.

Information pertaining to catchments, mean annual runoff 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.

### DESCRIPTION

#### ***Catchments within the context of South Africa***

The project area 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 (SLR, 2018a).

#### ***Regional hydrology***

The project area falls within the quaternary catchment D41K which has a gross total catchment area of 4 216 km<sup>2</sup>, with a net mean annual runoff (MAR) of 6.53 million cubic meters (mcm) (SLR, 2018a). The entire Moloto catchment which includes D41K is classified as endoreic i.e. catchments with large areas which do not contribute to runoff (SLR, 2018a).

The major river within quaternary catchment D41K is the Ga-Mogara drainage channel, which is located approximately 8 km north-west of MMT (see Figure 1). 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, 2019).

#### ***Local hydrology***

There are no watercourses within the project area and natural drainage across the project area is via sheet flow. The nearest watercourses are the ephemeral Vlermuisleegte River (approximately 3 km west) and the ephemeral Witleegte River (approximately 6 km northeast) (see Figure 16). 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 7-8 below. Natural runoff drains in a westerly direction and

north easterly direction towards the respective drainage lines. The normal dry weather flow of watercourses in the region is no flow.

**TABLE 7-8: CATCHMENT CHARACTERISTICS (SLR, 2019)**

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

### **Surface water quality**

No water sampling within the project area has been conducted because there are no permanent surface water features. Thus, 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 project area.

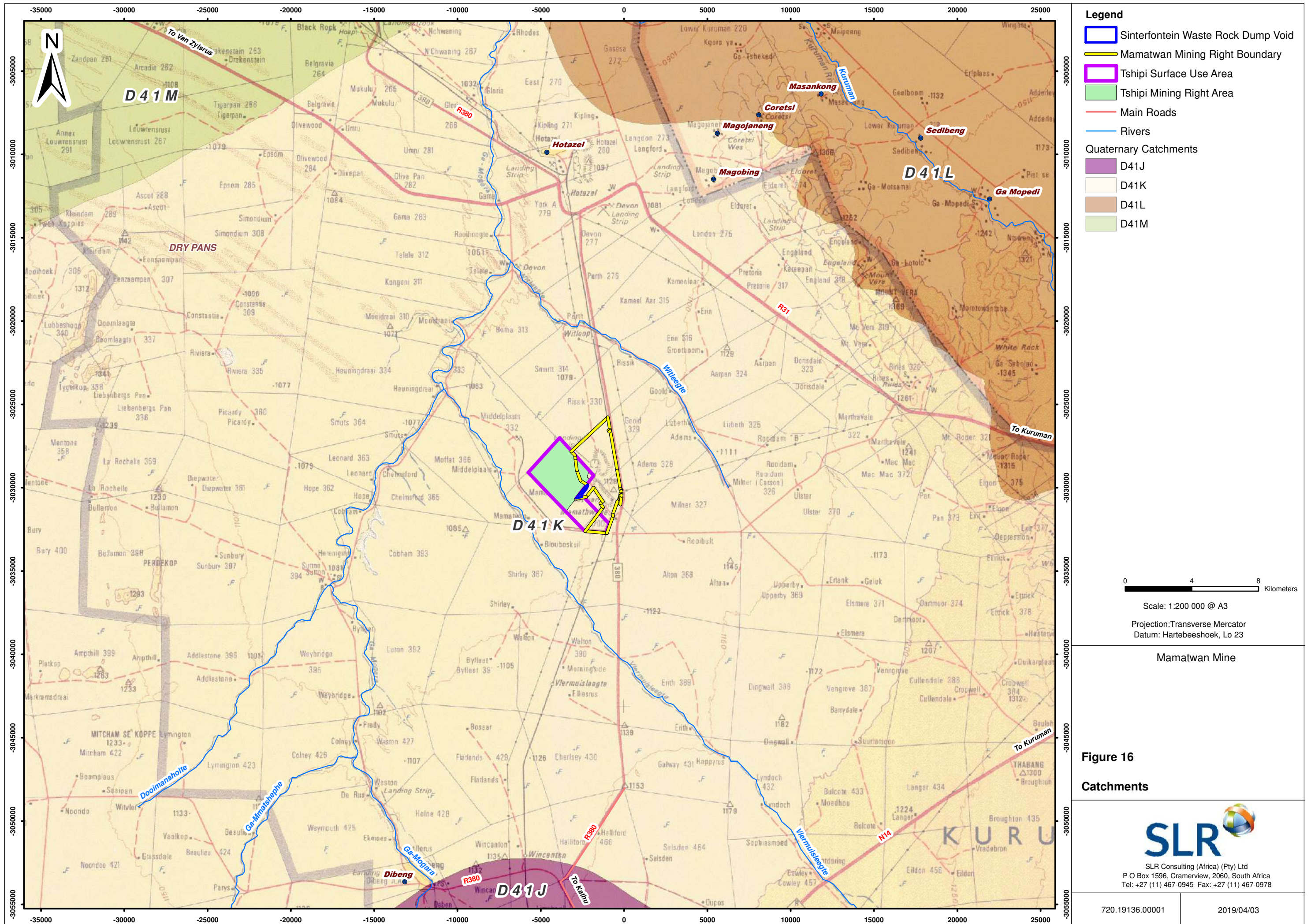
### **Wetlands**

No wetlands are located within the project area.

## **CONCLUSION**

Establishment of additional facilities at the mine has the potential to influence natural drainage patterns and contributions of runoff to the catchment. The proposed project also presents a potential for the contamination of surface water resources. These however need to be considered within the context of the distance of the proposed project to drainage lines, the sheet flow drainage patterns and the endoreic classification of the catchment.





- Legend**
- Sinterfontein Waste Rock Dump Void
  - Mamatwan Mining Right Boundary
  - Tshipi Surface Use Area
  - Tshipi Mining Right Area
  - Main Roads
  - Rivers
- Quaternary Catchments**
- D41J
  - D41K
  - D41L
  - D41M

0 4 8 Kilometers

Scale: 1:200 000 @ A3

Projection: Transverse Mercator  
Datum: Hartbeeshoek, Lo 23

**Mamatwan Mine**

**Figure 16**

**Catchments**



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## 7.4.1.7 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 waste rock have the potential to result in the loss of groundwater resources, both to the environment and third party users, through contamination.

### DATA SOURCES

Information in this section was sourced from groundwater studies completed for the adjacent Tshipi Borwa Mine (SLR, 2017; SLR, 2018) and the updated groundwater study completed for MMT in 2018 (GHT, 2018). Given that MMT is located adjacent to the Tshipi Borwa Mine, the baseline conditions as presented in the Tshipi specialist studies also apply to MMT. Information pertaining to aquifer characteristics was sourced from the Aquifer Classification Map of South Africa.

### DESCRIPTION

#### **Hydrogeology**

Two aquifers are present beneath the project area. This includes a shallow aquifer comprising the Kalahari sands and calcrete and a deeper fractured aquifer comprising Dwyka clay and Mooidraai dolomite formation. 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 base flow 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, 2017).

Based on the Aquifer Vulnerability Map of South Africa (Conrad *et al.*, 1999c), the Mamatwan area is classified as least to moderately vulnerable which implies the following:

- Least vulnerable: only vulnerable to conservative pollutants in the long-term when continuously discharged or leached; and
- Moderately vulnerable: vulnerable to some pollutants, but only when continuously discharged or leached.

#### **Groundwater levels and flow**

Groundwater flows across the mine area in accordance with the topography from the south-east to north-west. Natural groundwater levels and flows are influenced (although limited to the low permeability and storage characteristics of the aquifer) by open pit mining activities (GHT, 2018).

#### **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**

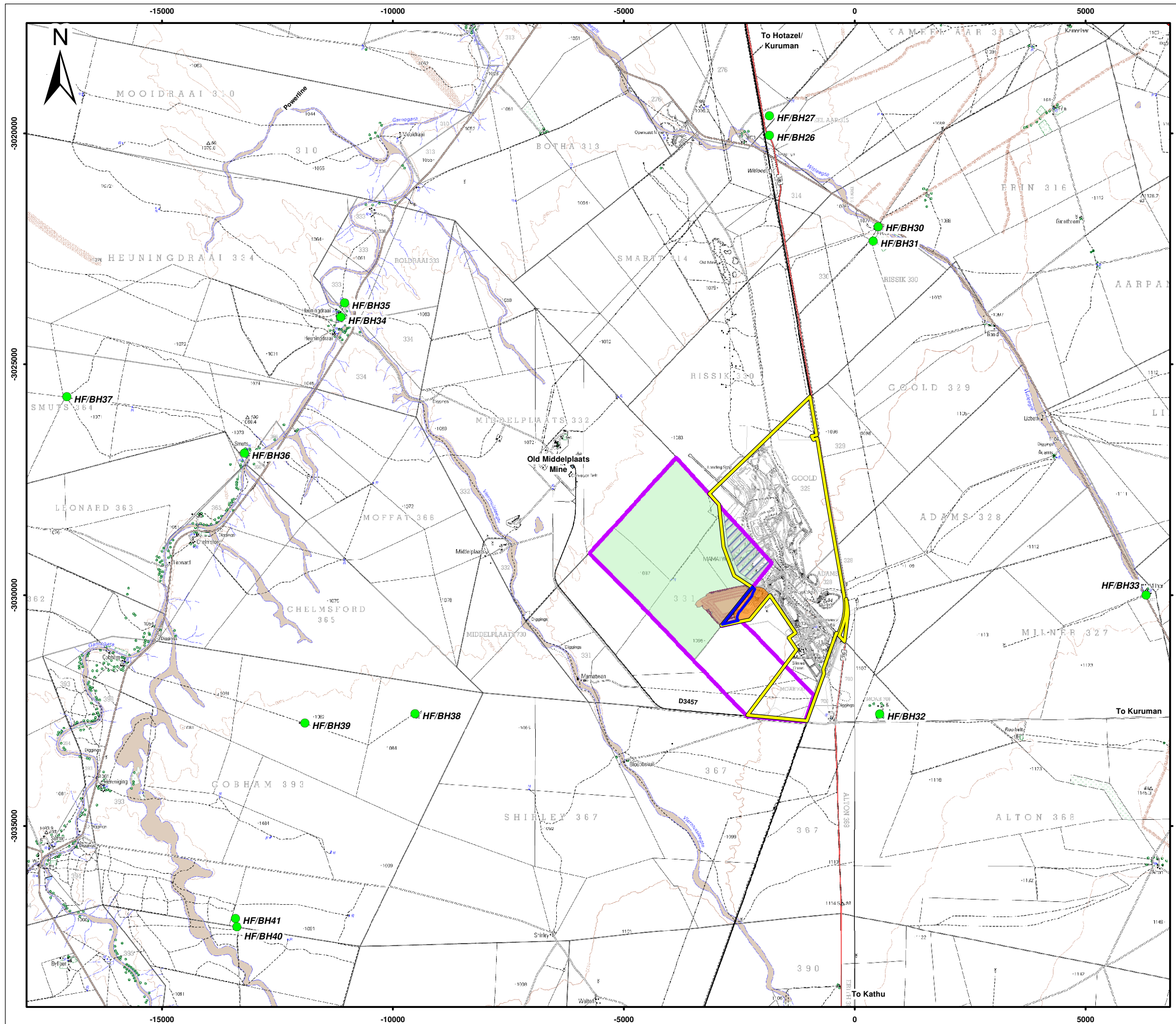
A regional hydrocensus was undertaken in 2018 by GHT. The hydrocensus included HMM monitoring boreholes and background farm (private) boreholes (Figure 17). The water quality results indicate that elevated concentrations of electrical conductivity (total dissolved solids), sodium, calcium, sulphate and nitrates can be attributed to mining activities in the direct vicinity of mining operations. The water quality results do however also show higher naturally occurring concentrations for these same parameters in parts of the hydrocensus study area i.e. at private farm boreholes.

Of the 14 hydrocensus farm boreholes sampled within the vicinity of the MMT, 10 of the boreholes classified above the recommended standard limit or Above Recommended Standards (ARS) in terms of the SANS 241 (2015) Drinking Water standards, which is approximately 71% of the samples. ARS water quality is described as water that is unsuitable for life time human consumption. The water quality is classified as ARS in general due to elevated concentrations of electrical conductivity, magnesium, nitrate and total hardness and to a lesser extent calcium, chloride, ammonium and aesthetic manganese. The elevated nitrate concentration is indicated by the specialist to be of natural origin as is expected for most semi-arid regions. Approximately 56% of the boreholes had elevated nitrate concentrations that classified above the ARS water quality. The remaining 11 hydrocensus farm boreholes classified as Class 1 (recommended standard limit) are considered suitable for lifetime consumption (GHT, 2018).

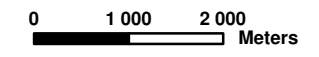
The Department of Water and Sanitation (DWS) has specified the Water Resource Quality Objectives (RQO) for the catchment D41K. When comparing the 2018 regional hydrocensus data to the DWS RQO for catchment D41K, a number of background hydrocensus boreholes (32) exceeded the DWS RQO for catchment for pH, sodium, calcium, magnesium, chloride, sulphate, fluoride, nitrate and total alkalinity (GHT, 2018).

### **CONCLUSION**

The extension of the WRD presents the potential for contamination of groundwater resources. Groundwater qualities have been influenced locally by existing mining activities. The project must be implemented / managed in a way that contamination of groundwater resources is minimised as far as possible.



- Legend**
- Final Merged Waste Rock Dump
  - Sinterfontein Waste Rock Dump Void
  - Mamatwan Mining Right Area
  - Mamatwan Sinterfontein Waste Rock Dump
  - Tshipi Eastern Waste Rock Dump
  - ▨ Boundary Pillar
  - Tshipi Surface Use Area
  - Tshipi Mining Right Area
  - Main Roads
  - Power Line
  - Rivers and Streams
  - 20m Contour Lines
  - Hydrocensus Boreholes



Scale: 1:80 000 @ A3  
 Projection: Transverse Mercator  
 Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 17**  
**Location of Hydrocensus Boreholes (GHT 2018)**

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### 7.4.1.8 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 completed for the adjacent Tshipi Borwa Mine (Airshed, 2018a). Given that MMT is located adjacent to the Tshipi Borwa Mine, the baseline conditions as presented in the specialist study also apply to MMT. Dust fallout monitoring data was sourced from the 2018 annual monitoring report compiled by SGS (SGS, 2019).

#### DESCRIPTION

##### ***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, Tshipi, Black Rock, Gloria, Wessels, Sebilo, United Manganese of Kalahari (UMK) and Kudumane;
- Biomass burning: Biomass burning emissions include with carbon monoxide (CO), methane (CH<sub>4</sub>) and nitrogen dioxide (NO<sub>2</sub>) 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<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), 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 PM<sub>10</sub>, nitrogen dioxide (NO<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), polycyclic aromatic hydrocarbons, particulate benzo(a)pyrene and formaldehyde; and
- Vehicle tailpipe emissions: Significant primary pollutants include carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), hydrocarbons (HCs), sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (mainly NO<sub>x</sub>),

particulates. Secondary pollutants include  $\text{NO}^2$ , photochemical oxidants (ozone), sulphur acid, sulphates and nitric acid.

### ***Emission sources associated with MMT***

The activities associated with MMT 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;
- Sintering;
- Excavations;
- Earthworks; and
- Removal of soil.

These emissions contribute towards both nuisance value, mainly in the immediate area of the source (large particle deposition or  $\text{PM}_{10}$ ) and potential increased health impacts.

### ***Dust fallout data***

MMT has a monthly dust fallout monitoring programme that commenced in January 2010 and consists of nine (9) single bucket monitors and one (1) dustwatch multi-directional monitoring unit. All monitoring points are located within or on the boundary of the MMT mining right area. Dust fallout monitoring results are compared to the non-residential dust fallout limits ( $600 < D < 1200$ ) in accordance with the National Dust Control Regulations (NDCR), however comparison to the residential limits for information purposes is also possible. The results indicated that all monitoring points were well below the non-residential limits and below the residential limits for the monitoring period (SGS, 2019).

### ***Potential air receptors***

Potential receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 3 and 6 km from the mine (refer to Figure 20). These are owned and/or occupied by farmers and farm workers.

## **CONCLUSION**

Air quality within and surrounding MMT has been influenced through the presence of mining activities and associated infrastructure. Monitoring results indicate that dust fallout from the existing mining operations is well below the NDCR limits. The proposed WRD extension presents an additional source 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 at potential receptor sites.

## 7.4.1.9 NOISE

### INTRODUCTION AND LINK TO IMPACT

Noise generating activities associated with the proposed extension of the WRD 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 are described in Section 7.4.2. To understand the basis of these potential impacts, a baseline situational analysis is described below.

### DATA SOURCE

Information in this section was sourced from noise sampling campaign completed for the adjacent Tshipi Borwa Mine in December 2018 (Airshed, 2018b). Background environmental noise levels were sampled at four locations to the south west and west of the Tshipi Borwa Mine as well as one location between Tshipi Borwa Mine and MMT. These levels were measured at a time when the mining operations were active.

### DESCRIPTION

The greater area is generally defined by rural features and is not subjected to elevated noise levels. Noise generating activities in the area include farming activities, localised traffic, train movements and mining operations.

Sampled background environmental noise levels were typical of rural areas with noise levels at some locations influenced by the presence of cicadas close to the sampling locations.

Potential noise receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 3 and 6 km from the WRD extension area. These are owned and/or occupied by farmers and farm workers.

### CONCLUSION

The proposed WRD extension has the potential to increase ambient noise levels within and surrounding the project area. The nearest potential noise sensitive receptors are located between 3 and 6 km from the WRD extension area. It is, however, important to note that the WRD extension area is located centrally between Tshipi and Mamatwan current mining activities, which already generate noise. Any project activities should be undertaken in a manner that minimises increasing disturbing noise levels.

## 7.4.1.10 VISUAL ASPECTS

### INTRODUCTION AND LINK

The establishment of both temporary and permanent mining related infrastructure has the potential to alter the landscape character in the project area and surrounding area. 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.

## DESCRIPTION

### ***Landscape character***

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

### ***Scenic quality***

The scenic quality of the project area 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 project area is considered to be low due the presence of existing mining activities. Although the area surrounding the project area has been influenced by the presence of existing mining operations, road infrastructure, powerline infrastructure, solar farm 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 that 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 project area is located within a "mining belt". Surrounding existing mining operations and the



infrastructure that supports these mines dominates the area to the west, north-west and north of the project area. It follows that the immediate area within and surrounding the project area 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 project area (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 south-east and east of the project area has a medium visual value. Locations within the project area, as well as those located to the north, north-west and west 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 establishment of the proposed WRD extension.

### **7.4.1.11 TRAFFIC**

#### **INTRODUCTION AND LINK**

Traffic from mining related projects 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 completed for the adjacent Tshipi Borwa Mine (Siyazi, 2017). Given that the MMT is located adjacent to the Tshipi Borwa Mine and makes use of the same intersection and access road, the baseline conditions as presented in the specialist study also apply to the MMT.

#### **DESCRIPTION**

##### ***Existing road network***

The existing road network comprises:

- The provincial R380 which lies to the east of the MMT and traverses in a south-north direction between Kathu and Hotazel (see Figure 18);

- The R31 which crosses the R380 north of MMT and provides access to the UMK and Kudumane Mines (see Figure 18); and
- The D3457 which lies to the south of MMT and provides access to both the Tshipi and MMTs. The D3457 traverse in an easterly direction towards Kuruman (see Figure 20).

**Existing traffic data**

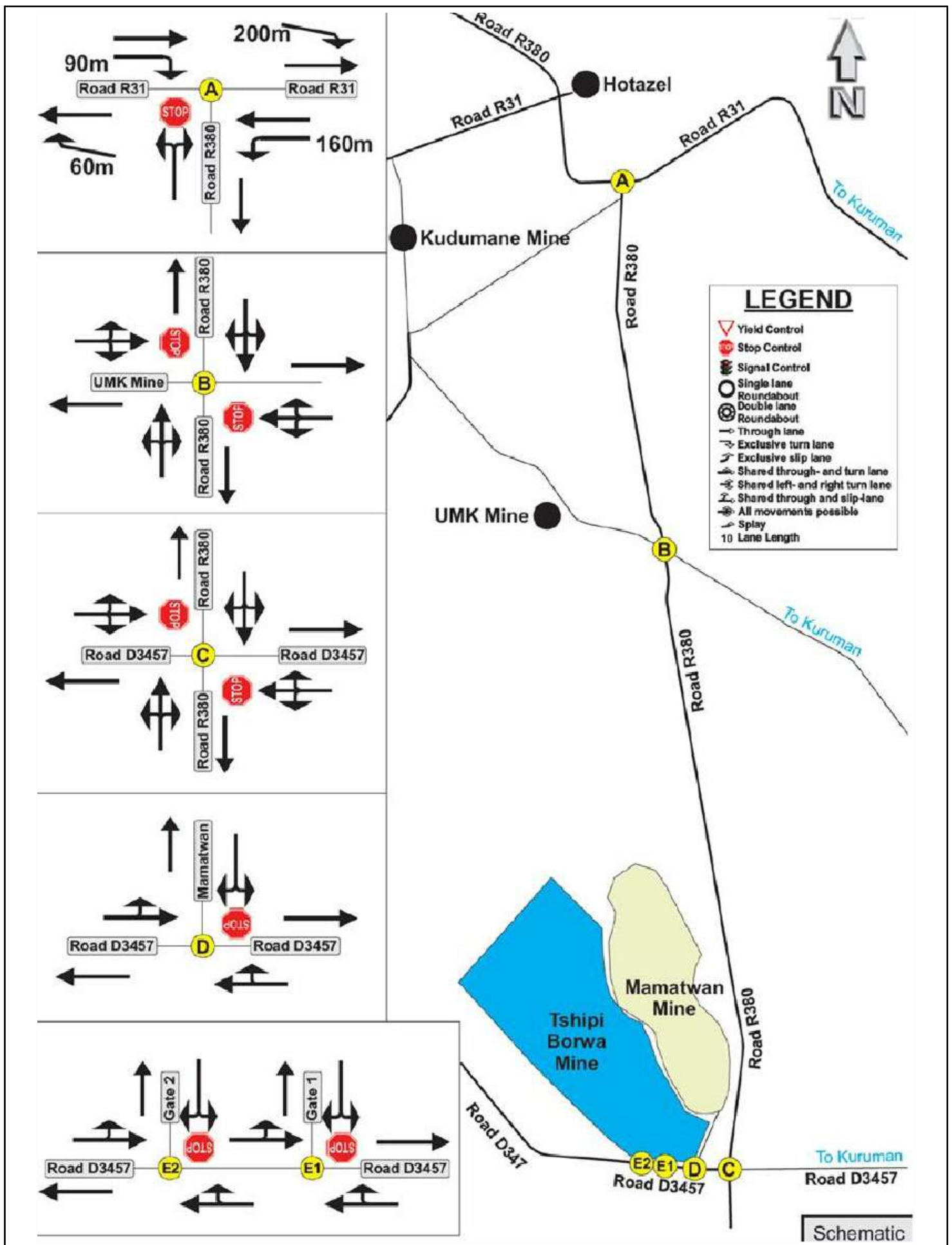
Manual 12-hour traffic counts undertaken at intersections along the R380 and at the MMT access road (refer to Figure 18) indicate that the peak traffic hours occur between 06h00 and 07h15 in the morning, and 13h00 and 16h30 in the afternoons (Table 7-9). All intersections that were investigated were considered to be operating at a good level of service.

**TABLE 7-9: TRAFFIC COUNT INFORMATION (SIYAZI, 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 access road	06h15 – 07h15	133	13h15 – 14h15	142
C	R380 and D3457	06h00 – 07h00	258	13h00 – 14h00	193
D	D3457 and MMT 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

**CONCLUSION**

The existing road network provides a fair level of service. The establishment of the proposed WRD extension will not alter the level of service, given that the project will not result in an increase in traffic volumes.



EXISTING ROAD NETWORK AND TRAFFIC COUNT INTERSECTIONS (SIYAZI, 2017)

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FIGURE 18

## 7.4.1.12 HERITAGE / CULTURAL AND PALAEOLOGICAL RESOURCES

### INTRODUCTION AND LINK

This section describes the existing status of the heritage and cultural environment that may be affected by the proposed 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.

Palaeontological 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 publicised (such as dinosaur and mammoth bones) to the more obscure but nevertheless scientifically important fossils (such as palaeobotanical remains, trace fossils, and microfossils). Palaeontological 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 exemption letter compiled for this BAR (see Appendix F) and the heritage impact study completed for the adjacent Tshipi Borwa Mine that covered the same study area (PGS, 2018).

### DESCRIPTION

The 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 were human settlements they tended to be located on or near watercourses.

The area proposed for the WRD extension remained undeveloped until at least the early 2000s with no indication of prior structural features. After which time, the area has formed part of a developing mine. No historic, Iron Age or Stone Age heritage sites were noted during the site visit (PGS, 2019).

Although the study area falls within a 'moderate' rated sensitivity zone (based on the SAHRIS palaeontological sensitivity map), previous palaeontological impact reports from the area have shown limited potential for the occurrence of palaeontological resources (PGS, 2018).

### CONCLUSION

There is a low possibility of palaeontological resources occurring in the project area. In addition to this, no heritage/cultural resources are associated with the proposed WRD extension area.

Palaeontological 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, South African Heritage Resources Agency (SAHRA) needs to be notified and where necessary permits need to be obtained prior to disturbance.

### 7.4.1.13 SOCIO-ECONOMIC

#### INTRODUCTION AND LINK

Typically mining projects have the potential to result in both positive and negative socio-economic impacts. The positive impacts are usually economic in nature with projects contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, projects indirectly contribute to economic growth in the national, local and regional economies. The negative impacts can be both social and economic in nature and related to the influx of people seeking job opportunities (with related social ills and pressures on existing services) and a change to existing land uses (with related changes to social structures and way of life).

#### DATA SOURCE

Information in this section was sourced from the Joe Morolong Local Municipality Integrated Development Plan of 2016 and StatsSA.

#### DESCRIPTION

The MMT is located in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province. The nearest community to the mine is the town Hotazel, located approximately 25km north of the MMT. No informal or rural type settlements occur within the surrounding areas.

The Hotazel community has a very low population of 1 755 people when compared to the local municipality population of 89 531 and the Northern Cape Province population of 1 145 861. This provides an indication of the remoteness of the project area.

In general, statistics throughout the identified regions indicate poor educational profiles. Significant numbers of the population within the municipalities and province have received no schooling or only limited primary education. The average number across the regions profiled of people completing high school education were relatively consistent; 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 province and district and local municipalities.

Majority of the population within the Northern Cape, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality are not economically active, while 48% of the Hotazel population is employed. There is a large dependency on subsistence agriculture, the public sector, seasonal workers and employment in the mining sector.

The population profile of the Northern Cape Province, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality demonstrates a consistent average household size of four people per household despite the significant decline in population numbers between the regional levels. The local community of Hotazel has 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.

The most dominant type of dwelling utilized within the Northern Cape Province, the John Taolo Gaetsewe District Municipality, the Joe Morolong Local Municipality and Hotazel is a formally constructed house or brick structure. Traditional dwellings (e.g. huts/ structures made of traditional material) are the second highest used dwelling type in the district and local municipalities with informal dwellings (e.g. shacks) being the second highest dwelling type within the Northern Cape Province. No traditional dwellings are located within the town of Hotazel; rather the second highest used dwelling type is flats.

In general, despite the relatively formalized housing infrastructure, basic services infrastructure appears to be far less formalized when considering the province and municipalities as a whole. 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.

## CONCLUSION

In general mining related projects have the potential to influence socio-economic conditions both positively and negatively to which the approved mine already contributes. Given that the proposed project is for the extension of the WRD, and does not change the nature or scale of the existing mining or mineral processing operations, the proposed project is unlikely to influence the socio-economic conditions of the area.

## 7.4.2 CURRENT LAND USES

### INTRODUCTION AND LINK

Mining-related 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, air pollution, noise pollution and visual impacts. 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 MMT and a deed search undertaken by SLR. 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.

### DESCRIPTION – MINING AND PROSPECTING RIGHTS

MMT through the legal entity Hotazel Manganese Mines (Pty) Ltd, holds a mining right (NC 256 MR) to mine manganese ore over portion 16 (portion of portion 1), portion 17 (portion of portion 2) of the farm Mamatwan 331, the farm Sinterfontein 748, portion 3 of the farm Moab 700, portion 4 of the farm Adams 328 and portion 5 and 6 of the farm Goolde 329. The mining rights boundary is illustrated in Figure 20.

## DESCRIPTION – LANDOWNERS WITHIN AND SURROUNDING THE MMT

The surface right owners and corresponding title deeds numbers of the land in and adjacent to the MMT mining right area is listed in Table 7-10 and Table 7-11 respectively. It is however important to note that the WRD extension will only take place on the farm Sinterfontein 748.

**TABLE 7-10: LAND OWNERSHIP WITHIN THE MMT MINING RIGHT AREA**

Portion	Landowner	Title deed number
<b>Mamatwan 331</b>		
Portion 16 (Portion of Portion 1)	Tshipi é Ntle Manganese Mining (Pty) Ltd	T416/2014
Portion 17 (Portion of Portion 2)	Tshipi é Ntle Manganese Mining (Pty) Ltd	T416/2014
<b>Sinterfontein 748</b>		
Portion 0	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
<b>Moab 700</b>		
Portion 3	Hotazel Manganese Mines (Pty) Ltd	T953/2009
<b>Adams 328</b>		
Portion 4	Hotazel Manganese Mines (Pty) Ltd	T338/2009
<b>Goolde 329</b>		
Portion 5	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 6	Gideon Poolman Familietrust	T3211/2015

**TABLE 7-11: LANDOWNERS ADJACENT TO THE MMT MINING RIGHT AREA**

Portion	Landowner	Title deed number
<b>Mamatwan 331</b>		
Remaining extent	Andries Mathys Van Den Berg	T594/ 1987
Portions 1 and 2	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 3		T953/2009
Portion 7	Transnet	T666/1965
Portion 8	Tshipi é Ntle Manganese Mining (Pty) Ltd	T515/1992
Portion 18 (Portion of Portion 3)	Tshipi é Ntle Manganese Mining (Pty) Ltd	T416/2014
<b>Moab 700</b>		
Portion 1	Transnet	T250/1983
Remaining extent	Machiel Andries Kruger	T594/1987
<b>Middelplaats 332</b>		
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
<b>Middleplaats 184</b>		
Whole farm	Abraham Johannes De Klerk	T1135/1965
<b>Adams 328</b>		
Remaining Extent	Saltrim Ranches (Pty) Ltd	T2297/2006
Portion 1	Eskom Holdings	T347/1971
Portion 2		T1162/1982
Portion 3	Transnet	T1107/1992
<b>Rissik 330</b>		

Portion	Landowner	Title deed number
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
<b>Goolde 329</b>		
Portion 1	Kruger Machiel Andries	T399/1977
Portion 2	Kruger Nicolaas Philippus Fourie	T455/2010
Portion 8	Transnet	T515/1992
Portion 9	Hotazel Manganese Mines (Pty) Ltd	T2821/2011
<b>Shirley 367</b>		
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
<b>Smatt 314</b>		
Portion 0	Terra Nominees (Samancor Manganese)	T2396/1996
Portion 1	Transnet	T221/1966
<b>Alton 368</b>		
Portion 0	Booyesen Jacomina Maria	T285/1979
Portion 1	Andries Matthys Duvenhage Testamentere	T905/2009
<b>Milner 327</b>		
Whole Farm	Kruger Machiel Andries	T26/1931

#### DESCRIPTION – LAND CLAIMS

The Department of Rural Development and Land Reform: Land Claims Commissioner was contacted on 26 March 2019 to confirm if any land claims have been lodged on the farm Sinterfontein 748. The Land Claims Commissioner has confirmed that no land claims have been lodged on the farm Sinterfontein 748. Proof of correspondence is included in Appendix C.

#### DESCRIPTION – LAND USE AT THE PROJECT SITE

Land use at the project site includes existing mining activities and infrastructure associated with MMT mining right area.

#### DESCRIPTION – LAND USE SURROUNDING THE MMT

Land uses surrounding the MMT is a mixture of agriculture, isolated residence/ residential areas, infrastructure/servitudes, mining and solar activities. More detail is provided below.

##### **Agriculture**

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

##### **Isolated residence/ residential area**



With reference to Figure 19, the nearest towns / residential areas to the MMT include:

- The Black Rock mining community located approximately 30 km north west of the MMT;
- Hotazel situated approximately 20 km north of the MMT;
- Kuruman located approximately 45 km south-east of the MMT; and
- Kathu located approximately 40 km to the south of the MMT.

Due to the lack of available surface water resources in the area, no informal settlements are located in immediate proximity to the MMT. 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 Middelpplaats 332 located approximately 5 km and 4 km north-west from the proposed WRD extension area and the MMT respectively (see Figure 20);
- A permanent farm homestead (A. Pyper) located on the Farm Middelpplaats 332 approximately 2 km west and 3 km north-west of the MMT and proposed WRD extension, respectively (see Figure 20);
- A permanent farm homestead (Andries van den Berg) located on the Farm Mamatwan 331 approximately 4 km and 3 km west from the MMT and proposed WRD extension area, respectively (see Figure 20); and
- A permanent farm homestead (Nic Fourie) located on the Farm Shirley 367 slightly less than 5 km and 4 km south-west from the MMT and proposed WRD extension area, respectively (see Figure 20).

### ***Infrastructure and servitudes***

A 132 kV powerline is located to the east of the MMT, alongside the R380 Hotazel to Kathu road (see Figure 20).

The Sedibeng Vaal-Gamagara water supply pipeline supplies the MMT with process and potable water. A pipeline connection to the Sedibeng Vaal-Gamagara reservoir is located approximately 1 km south of the MMT (see Figure 20).

The Transnet railway line that services the mines of the Kalahari Basin, from Black Rock in the north to Mamatwan and Tshipi in the south passes to the east of MMT with a private siding onto the mine from where ore is loaded and despatched for export (see Figure 20).

### ***Surrounding mines***

Various other mining operations located in the immediate vicinity of the MMT include (see Figure 19):

- The Sebilo Mine (Sebilo Resources (Pty) Ltd) – Located approximately 7 km north from the nearest section of the MMT;
- The dormant / temporarily closed Middelpplaats Mine – Located approximately 4 km north-west from the nearest section of the MMT;
- United Manganese of Kalahari Mine (Pty) Ltd) – Located approximately 2 km north from the nearest section of the MMT; and

- The Tshipi Borwa Mine (Tshipi é Ntle Manganese Mining (Pty) Ltd – Located directly adjacent to the eastern boundary of the MMT.

Mining operations located further afield from the MMT include the:

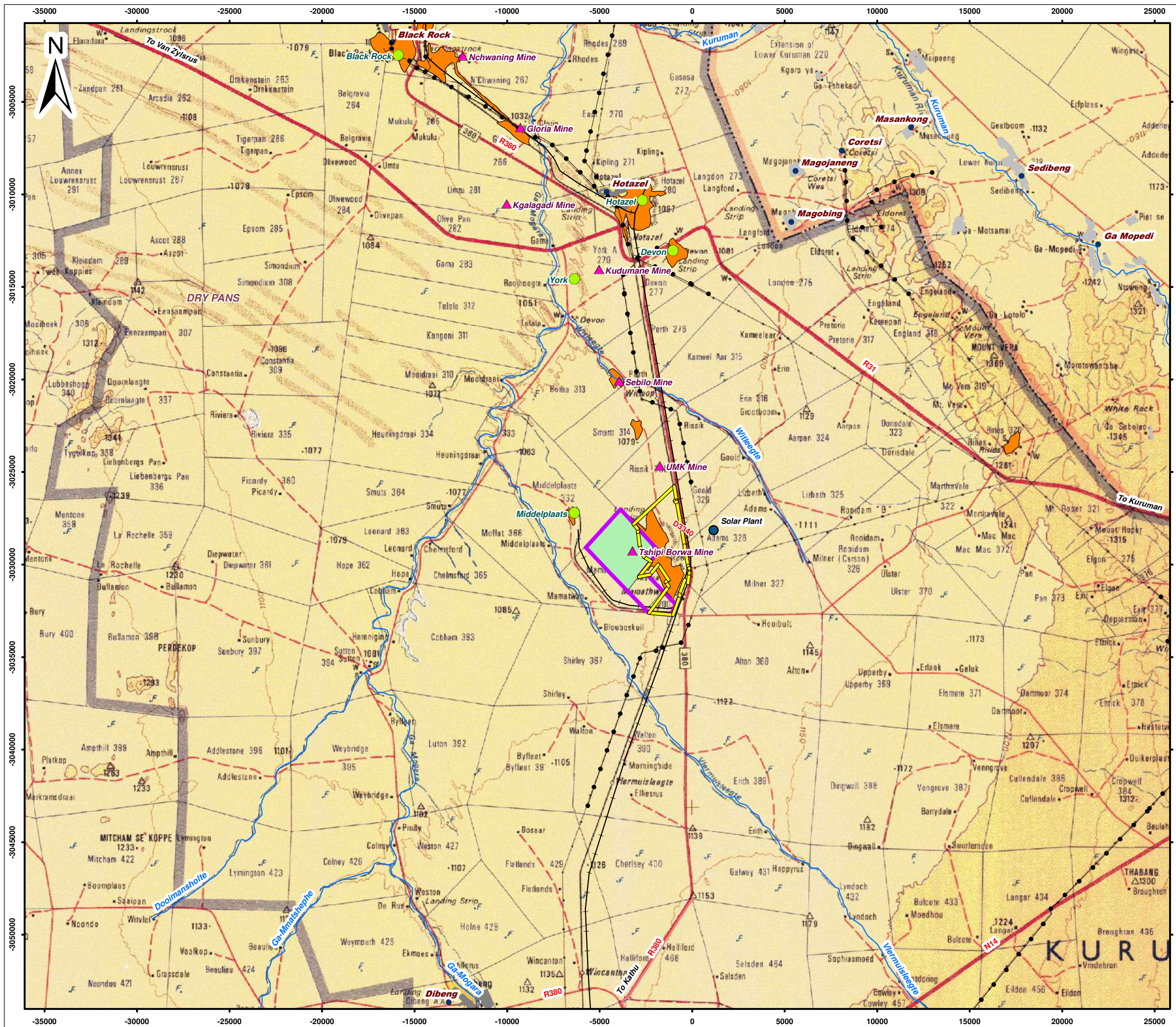
- The Wessels Mine (South32) – Located approximately 28 km north from the nearest section of the MMT;
- The Nchwaning/Black Rock Mine (Assmang (Pty) Ltd) – Located approximately 26 km north from the nearest section of the MMT;
- The Gloria Mine (Assmang (Pty) Ltd) – Located approximately 21 km north from the nearest section of the MMT;
- The Kalagadi Mine (Kalagadi Manganese (Pty) Ltd) – Located approximately 17 km north west from the nearest section of the MMT;
- The Kudumane Mine (Kudumane Manganese Resources (Pty) Ltd) – Located approximately 13 km north from the nearest section of the MMT;
- The old Hotazel Mine (dormant/closed) – Located approximately 15 km north east from the nearest section of the MMT;
- The old Devon mine (dormant/closed) – Located approximately 14.7 km north east from the nearest section of the MMT; and
- The old York Mine (dormant/closed) – Located approximately 12.8 km north from the nearest section of the MMT.

### **Solar plant**

The Adams Solar Plant (Adams Solar PV Project Two (Pty) Ltd), owned by Enel Green Power (Pty) Ltd, is situated approximately 1.5 km east of the MMT 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.

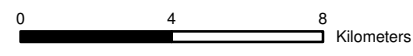
### **CONCLUSION**

There are a number of land uses within and surrounding the project area which may be influenced by the proposed WRD extension and associated potential environmental impacts. It should, however, be noted that land has already been significantly influenced through mining and agricultural activities and associated infrastructure and servitudes.



- Legend**
- Mamatwan Mining Right Boundary
  - Tshipi Surface Use Area
  - Tshipi Mining Right Area
  - ▲ Operating Manganese Mines
  - Closed/Dormant Mines
  - High Urban Density
  - Low Urban Density
  - Mines & quarries\*
  - Main Roads
  - Rivers and Streams
  - Railway
  - Powerline

Note:  
\* Sourced from SANBI



Scale: 1:200 000 @ A3  
Projection: Transverse Mercator  
Datum: Hartbeeshoek, Lo 23

Mamatwan Mine

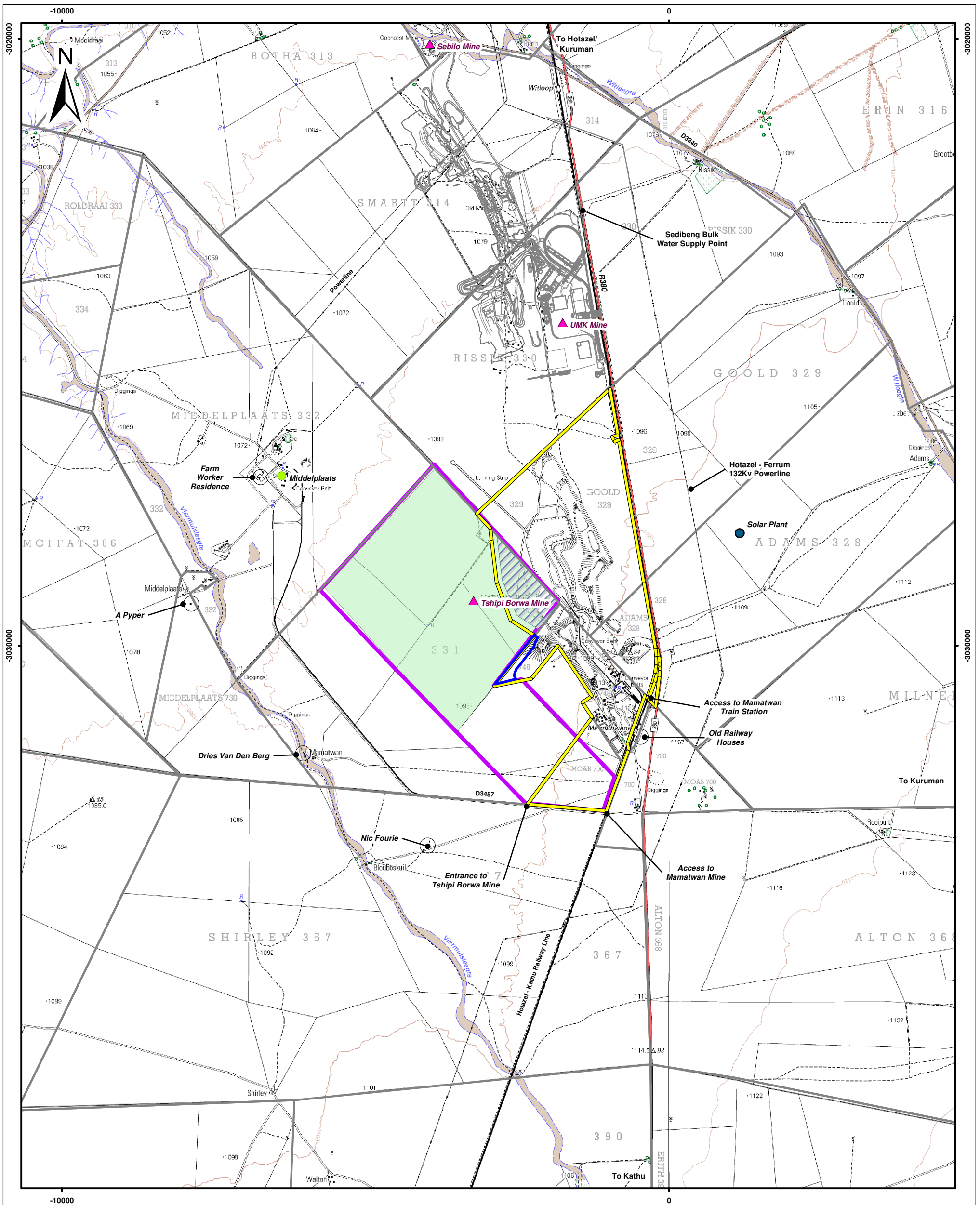
**Figure 19**  
**Regional Land Use Map**



SLR Consulting (Africa) (Pty) Ltd  
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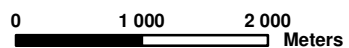
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**Legend**

- Sinterfontein Waste Rock Dump Void
- Mamatwan Mining Right Boundary
- ▲ Operating Manganese Mines
- Closed/Dormant Mines
- Boundary Pillar
- Tshipi Surface Use Area
- Tshipi Mining Right Area
- Main Roads
- Secondary Roads
- Power Line
- Rivers and Streams



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

**Mamatwan Mine**

**Figure 20**

**Local Land Use**



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### 7.4.3 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

The environmental features and infrastructure in the study area is described in Section 7.4.1. In summary:

- Soils in the proposed WRD extension area are well-drained sandy soil, which allows for high infiltration rates and low organic content and is highly erodible. The soil fertility is low due to a deficiency in key nutrients, such as phosphorus. Soil located in the proposed WRD extension area has been influenced by existing mining activities and as such the ability of this soil form to support vegetation and land use options have been affected.
- The proposed WRD extension footprint lies within the Kathu Thornveld habitat. The proposed extension footprint is not located in a threatened ecosystem, CBAs, ESA, or IBAs, or an area earmarked as part of the NPAES, or an area ranked as a priority area by the Mining and Biodiversity Guideline (2012). The WRD extension area is considered to have a moderate to low sensitivity.
- No watercourses or wetlands are located within the project area.
- Groundwater quality had been influenced by anthropogenic pollution from farming and surrounding mining activities.
- Air quality, noise and aesthetics within and surrounding the MMT has already been influenced through the presence of mining activities and associated infrastructure.
- There is a low possibility of palaeontological resources occurring in the project area. No heritage/cultural resources were identified within the proposed WRD extension area.
- The notable infrastructure surrounding the surface use area includes roads (R380), a railway line, powerline and a water pipeline (Vaal Gamagara). The existing road network provides a fair level of service. The establishment of the proposed WRD extensions will not alter the level of service.
- There area surrounding the MMT is sparsely populated and is characterised by isolated farmsteads located within a 5 km radius of the MMT, with the closes town (Hotazel) located approximately 20 km from the MMT. The areas surrounding the MMT have also been influenced by surrounding dormant and active mines within a 7 km radius. This includes mines such as the Sebilo Mine, the dormant Middelpaats Mine, the UMK mine and the adjacent Tshipi Borwa Mine.

### 7.4.4 ENVIRONMENT AND CURRENT LAND USE MAP

A conceptual map showing topographical information as well as land uses on and immediately surrounding the MMT is provided in Figure 19 and Figure 20.

### 7.5 ENVIRONMENTAL IMPACTS AND RISKS

As noted in Section 7.1, no site layout or infrastructure locational alternatives are being considered and as such an assessment of alternatives is not applicable to the project.

### 7.6 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The method used for the assessment of environmental issues is set out in Table 7-12. 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.

**TABLE 7-12: IMPACT ASSESSMENT METHODOLOGY**

Note: Part A provides the definition for determining impact consequence (combining intensity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

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

	<b>L</b>	<b>M</b>	<b>H</b>
	Localised	Fairly widespread	Widespread

Within site boundary Site	Beyond site boundary Local	Far beyond site boundary Regional/ national
<b>SPATIAL SCALE</b>		

PART C: DETERMINING SIGNIFICANCE					
<b>PROBABILITY (of exposure to impacts)</b>	Definite/ Continuous	<b>H</b>	<b>Medium</b>	<b>Medium</b>	<b>High</b>
	Possible/ frequent	<b>M</b>	<b>Medium</b>	<b>Medium</b>	<b>High</b>
	Unlikely/ seldom	<b>L</b>	<b>Low</b>	<b>Low</b>	<b>Medium</b>
			<b>L</b>	<b>M</b>	<b>H</b>
<b>CONSEQUENCE</b>					

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	Decision guideline
High	It would influence the decision regardless of any possible mitigation.
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.

### 7.7 POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

As noted in Section 7.1, no site layout or infrastructure locational alternatives are being considered and as such an assessment of alternatives is not applicable to the project. The preferred project alternative is assessed in Section 9.

## 7.8 POSSIBLE MANAGEMENT ACTIONS THAT COULD BE APPLIED AND THE LEVEL OF RISK

A summary of issues and concerns raised by I&APs during the EIA process is provided in Section 0. A list of the potential impacts identified by SLR and/or raised by I&APs, as well as the possible management and mitigation measures, is provided in Table 7-13. The level of residual risk after management or mitigation is also estimated.

**TABLE 7-13: POSSIBLE MANAGEMENT ACTIONS AND THE ANTICIPATED LEVEL OF RISK**

Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation	
		Unmitigated	Mitigated
I am just interested in knowing more about the air pollution that might emanate from this project.	<ul style="list-style-type: none"> <li>• Implementation of dust monitoring programme</li> <li>• Implementation of dust suppression (eg. water sprays)</li> <li>• Fill waste rock in the void and avoid tipping waste rock from the crest of the existing WRD. Once the void is filled, dump waste rock on the WRD in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position.</li> <li>• Re-vegetation of WRD and topsoil stockpile sides lopes</li> <li>• General good housekeeping</li> <li>• Maintain a complaints register that is available at the mine.</li> </ul>	Low	Low
I am just interested in knowing more about the visual impact that might emanate from this project.	<ul style="list-style-type: none"> <li>• Clear and expose only the footprint area as defined by the approved layout in this EMP.</li> <li>• Implementation of dust suppression (eg. water sprays).</li> <li>• Effectively rehabilitate the WRDs that reflect the natural vegetation of the area, as far as is practicable.</li> </ul>	Insignificant	Insignificant



Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation	
		Unmitigated	Mitigated
	<ul style="list-style-type: none"> <li>• Shape any residual WRDs left on surface.</li> <li>• Care and maintenance of final rehabilitated areas.</li> </ul>		
<p>Protected trees such as <i>Vachelle erioloba</i>, <i>Vachellia Haematoxylon</i> and <i>Bascia albitrunca</i> can be found in the study area. It is unlikely the impact would be significant by merging the 18m wide void between the two waste rock dumps, because the area has already been impacted by mining activities. In the event that protected trees are encountered, the mines must apply for a Forest Act Licence prior to disturbance of trees.</p> <p>Provincially protected plants are known to occur in the vicinity of the study site and may not be damaged, disturbed or relocated without a valid Flora Permit from the provincial Department of Environment and Nature Conservation, under the Northern Cape Nature Conservation Act, No. 9 of 2009, if affected.</p> <p>Trees with birds nest may not be disturbed without a valid Fauna Permit from Nature Conservation, under the Northern Cape Nature Conservation Act, No. 9 of 2009.</p> <p>Getting a Forest Act Licence can take up to 30 days. Licence application forms are available on the Departmental website or at only Forestry Office. The Department may ask for supporting documentation when assessing a licence application. For construction activities of this nature, the following supporting documents are normally requested:</p> <ul style="list-style-type: none"> <li>• Completed Licence Application Form</li> <li>• Accurate estimation of the number of trees to be felled per species</li> <li>• Copy of ID</li> <li>• Copy of Environmental Authorisation</li> </ul>	<ul style="list-style-type: none"> <li>• While no protected plant or tree species were identified within the proposed project area, if any protected species are encountered, the necessary permits need to be obtained from the DAFF (tree permits) and DENC (Plant permits). If any active bird nests are observed within the proposed project footprint, the necessary permits need to be obtained from DENC prior to disturbance;</li> </ul>	Medium	Low

Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation	
		Unmitigated	Mitigated
<ul style="list-style-type: none"> <li>• Flora Permit Reference number</li> <li>• Copy of Fauna Permit (if applicable).</li> </ul>			

## 7.9 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

No feasible alternatives exist for the proposed project. Refer to Section 7.1 for further detail.

## 7.10 STATEMENT MOTIVATING THE PREFERRED ALTERNATIVE

No feasible alternatives exist for the proposed project and as such this section is not applicable. Refer to Section 7.1 for further detail.

## 8 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

### 8.1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

Biophysical and socio-economic impacts associated with the proposed project were identified through a site visits undertaken by SLR and specialists, and the specialist studies.

As part of the public participation process, I&APs and commenting authorities (see Section 7.2) are being provided with opportunities to provide input into the BAR process and comment on the proposed project, including the identification of environmental and socio-economic impacts.

### 8.2 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 7.6.

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

Table 8-1 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 8-1: LIST OF POTENTIAL IMPACTS AS THEY RELATED TO THE PROPOSED PROJECT**

Potential impact	Activity	Alternative	Project phases
Loss and sterilization of mineral resources	Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure
Altering topography	Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure
Loss of soil resources and land capability through contamination and physical disturbance	Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure

Potential impact	Activity	Alternative	Project phases
Physical destruction and general disturbance of biodiversity	Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure
Alteration of natural drainage patterns	Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure
Contamination of surface water resources	Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure
Contamination of groundwater resources	Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Operation Decommissioning Closure
Air pollution	Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure
Increase in disturbing noise levels	Earthworks Waste rock disposal Rehabilitation of land form	WRD extension	Construction Operation Decommissioning
Negative visual impacts	Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Operation Decommissioning Closure
Loss of or damage to heritage and/or palaeontological resources	Earthworks Waste rock disposal	WRD extension	Construction Operation
Change in land use	Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	WRD extension	Construction Operation Decommissioning Closure

#### 8.4 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 potential impacts, including the extent to which impacts can be avoided or mitigated, is included in Section 9 and Appendix E.

## 9 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

A summary of the assessment of the biophysical and socio-economic impacts associated with the proposed project is provided in Table 9-1 below. A full description of the assessment is included in Appendix E.

**TABLE 9-1: 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 reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Loss and sterilisation of mineral resources	Geology	Construction Operation Decommissioning Closure	Insignificant	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>	Insignificant	Not applicable
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Altering topography	Topography	Construction Operation Decommissioning Closure	Insignificant	<ul style="list-style-type: none"> <li>Control through management and design</li> <li>Control through rehabilitation</li> </ul>	Insignificant	Can be managed/mitigated to acceptable levels
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Loss of soil resources and land capability through physical disturbance and contamination	Soil and land capability	Construction Operation Decommissioning Closure	Insignificant	<ul style="list-style-type: none"> <li>Control through footprint disturbance limitation</li> <li>Control through waste management procedures</li> <li>Control through soil management procedures</li> </ul>	Insignificant	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 reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
					<ul style="list-style-type: none"> <li>Control through rehabilitation</li> <li>Remedy through emergency response procedure (Section 29.2.2)</li> </ul>		
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Physical destruction and general disturbance of biodiversity	Biodiversity	Construction Operation Decommissioning Closure	Medium	<ul style="list-style-type: none"> <li>Manage through concurrent rehabilitation</li> <li>Control through footprint limitation</li> <li>Manage through alien plant control plan</li> <li>Control through obtaining permits (if necessary)</li> <li>Remedy through emergency response procedure (Section 29.2.2)</li> </ul>	Low	Can be managed/mitigated to acceptable levels
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Alteration of natural drainage patterns	Surface water	Construction Operation Decommissioning Closure	Insignificant	<ul style="list-style-type: none"> <li>Manage through separation of clean and dirty water</li> <li>Control through prevention of dirty water entering natural environment</li> </ul>	Insignificant	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 reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Contamination of surface water		Construction Operation Decommissioning Closure	Insignificant	<ul style="list-style-type: none"> <li>• Manage through infrastructure design</li> <li>• Control through use of existing stormwater infrastructure</li> <li>• Manage through monitoring (Section 28)</li> <li>• Remedy through emergency response procedure (Section 29.2.2)</li> </ul>	Insignificant	Can be managed/mitigated to acceptable levels
Waste rock disposal Rehabilitation of land forms Final land forms	Contamination of groundwater	Groundwater	Operation Decommissioning Closure	Low	<ul style="list-style-type: none"> <li>• Management through infrastructure design</li> <li>• Manage through modelling and monitoring (Section 28)</li> <li>• Remedy through emergency response procedure (Section 29.2.2)</li> </ul>	Low	Can be managed/mitigated to acceptable levels
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Air pollution	Air	Construction Operation Decommissioning Closure	Low	<ul style="list-style-type: none"> <li>• Control through dust suppression</li> <li>• Manage through rehabilitation</li> <li>• Manage through complaints response</li> </ul>	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 reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
					<ul style="list-style-type: none"> <li>Manage through monitoring (Section 28)</li> </ul>		
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Increase in disturbing noise levels	Noise	Construction Operation Decommissioning	Insignificant	<ul style="list-style-type: none"> <li>Manage through equipment maintenance</li> <li>Manage through proper equipment operation</li> <li>Manage through monitoring on receipt of noise complaint</li> <li>Manage through annual noise monitoring (Section 28)</li> </ul>	Insignificant	Can be managed/mitigated to acceptable levels
Waste rock disposal Rehabilitation of land forms Final land forms	Negative visual views	Visual	Operation Decommissioning Closure	Insignificant	<ul style="list-style-type: none"> <li>Manage through footprint limitation</li> <li>Manage through rehabilitation</li> </ul>	Insignificant	Can be managed/mitigated to acceptable levels
Site preparation Earthworks Waste rock disposal	Loss of heritage/cultural and palaeontological resources	Heritage/cultural and palaeontological resources	Construction Operation	Insignificant	<ul style="list-style-type: none"> <li>Manage through change find procedure (Section 29.2.2)</li> </ul>	Insignificant	Can be managed/mitigated to acceptable levels
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Land use	Change in land use	Construction Operation Decommissioning Closure	Low	<ul style="list-style-type: none"> <li>Manage through communication structures</li> <li>Manage through rehabilitation</li> </ul>	Low	Can be managed/mitigated to acceptable levels

## 10 SUMMARY OF SPECIALIST REPORT FINDINGS

It is important to note that Tshipi has commenced with their EMPr amendment process to cater for the merging of the WRDs. As part of the Tshipi EMP amendment process, specialist studies were undertaken. The majority of the specialist studies undertaken as part of the Tshipi EMPr amendment process also cater for the Sinterfontein WRD extension footprint area. It follows that reference will be made to specialist studies undertaken by Tshipi that adequately caters for the Sinterfontein WRD extension footprint area.

The recommendations made by the specialist in support of the proposed project are summarised in Table 10-1 below. Specialist studies undertaken for Tshipi that will be reference in this BAR, also cater for multiple project aspects inclusive of the merging of the WRD's. For the purpose of this BAR, only specialist recommendations specific to the Sinterfontein WRD extension footprint are tabulated below.

**TABLE 10-1: SUMMARY OF SPECIALIST RECOMMENDATIONS**

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
Hydrology	<ul style="list-style-type: none"> <li>Stormwater management which overall includes prevention of clean water from entering dirty catchments by berms, collection and conveyance of dirty storm water and containment of dirty runoff water into the various dirty water dams.</li> <li>The reuse of dirty water will be prioritised as much as is practical.</li> <li>Design standards should be followed as presented in the WRDs detailed design for EMP 2, SLR June 2018.</li> <li>In addition clean-up material and materials safety data sheets for chemical and hazardous substances should be kept on site for immediate clean-up of accidental spillages of pollutants.</li> <li>All measures implemented for the mitigation of impacts should be regularly reviewed, as best practice, and in compliance with various licences (including WULs).</li> </ul>	X	Appendix E and Section 26
Groundwater	<ul style="list-style-type: none"> <li>In the event that water quality monitoring around any pollution sources indicates that these sources are causing pollution, additional management measures will be investigated in consultation with a qualified specialist.</li> </ul>	X	Appendix E and Section 26

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	<ul style="list-style-type: none"> <li>• Should any off-site contamination be detected, the mine will immediately notify DWS.</li> <li>• The groundwater model will be re-run periodically during the operational phase 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.</li> <li>• In case of a major discharge incident that may result in the pollution of groundwater resources the emergency response procedure will be followed.</li> </ul>		
Soil, Land Use and Land Capability (Terra Africa, 2018)	<p>Soil management during the construction phase:</p> <ul style="list-style-type: none"> <li>• Minimise the development footprint.</li> <li>• Management and supervision of construction teams.</li> <li>• Implement best practice for erosion prevention or minimisation during excavation.</li> <li>• Locate stockpiles where they will not become contaminated.</li> <li>• Topsoil stripping and stockpile specifications</li> <li>• Management of access and haul roads.</li> <li>• Prevention of soil contamination.</li> </ul> <p>Soil management during the operational phase:</p> <ul style="list-style-type: none"> <li>• Topsoil stripping, stockpiling and management should follow the guidelines as stipulated under the construction phase above.</li> </ul> <p>Soil management during the decommissioning phase:</p> <ul style="list-style-type: none"> <li>• Management and supervision of decommissioning teams.</li> <li>• Site preparation.</li> <li>• Seeding and re-vegetation.</li> <li>• Prevention of soil contamination.</li> </ul> <p>Soil management during the closure phase:</p> <ul style="list-style-type: none"> <li>• Maintenance and aftercare of final rehabilitated land.</li> </ul>	X	Appendix E and Section 26

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	<ul style="list-style-type: none"> <li>Frequent visual observations should be undertaken to confirm if vegetation has re-established and if any erosion gullies have developed. In the event that vegetation has not re-established, and erosion gullies have developed, remedial action should be taken.</li> </ul>		
Heritage (PGS, 2018)	<ul style="list-style-type: none"> <li>In the event that heritage resources are discovered during site clearance, construction activities must stop and a qualified archaeologist appointed to evaluate and make recommendations on mitigation measures.</li> <li>Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the Environmental Control Officer (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 mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.</li> </ul>	X	Appendix E and Section 26
Air Quality	<ul style="list-style-type: none"> <li>Provide water sprays or other dust management measures at all tipping points.</li> <li>A comprehensive dust management plan is required for the mine with specific mitigation measures, the frequency of application and the responsible divisions and persons indicated.</li> <li>It is recommended that the dust fallout monitoring should follow the ASTM D1739 (1970) method, as required by the NDCR, on the dustfall unit design, the dust collection and analysis. Dustfall results should be reported annually to the District Municipality Air Quality officer.</li> <li>Any binding properties would reduce the potential for wind erosion from the WRDs and topsoil piles. One of the most effective measures of minimizing wind erosion emissions is re-vegetation.</li> </ul>	X	Appendix E and Section 26

## 11 ENVIRONMENTAL IMPACT STATEMENT

### 11.1 SUMMARY OF KEY FINDINGS

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 9), associated with the preferred alternative (as per Section 5.3), in the unmitigated and mitigated scenarios for all project phases is included in Table 11-1 below.

The assessment of the proposed project presents the potential for negative impacts to occur (in the unmitigated scenario in particular) on the biophysical, 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 EMPr is effectively implemented there is no biophysical, social or economic reason why the project should not proceed.

**TABLE 11-1: SUMMARY OF POTENTIAL IMPACTS**

Aspect	Potential impact	Cumulative impact significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	Insignificant	Insignificant
Topography	Altering topography	Insignificant	Insignificant
Soil and land capability	Loss of soil resources and land capability through contamination and physical disturbance	Insignificant	Insignificant
Biodiversity	Physical destruction and general disturbance of biodiversity	Medium	Low
Surface water	Alteration of natural drainage patterns	Insignificant	Insignificant
	Contamination of surface water resources	Insignificant	Insignificant
Groundwater	Contamination of groundwater resources	Low	Low
Air quality	Air pollution	Low	Low
Noise	Increase in disturbing noise levels	Insignificant	Insignificant
Visual	Negative visual views	Insignificant	Insignificant
Traffic	Road disturbance and traffic safety	Not applicable	Not applicable
Heritage/cultural and palaeontological resources	Loss of heritage/cultural and Palaeontological resources	Insignificant	Insignificant
Socio-economic	Inward migration and economic impact	Not applicable	Not applicable
Land use	Change in land use	Low	Low

### 11.2 FINAL SITE MAP

The final preferred site layout plan is included in Figure 7.

### 11.3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPACTS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

With reference to Sections 7.1 no site layout or infrastructure locational alternatives were considered and as such this section is not applicable.

## 12 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.

### 12.1 PROPOSED MANAGEMENT OBJECTIVES AND OUTCOMES FOR ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

Specific environmental objectives to control, remedy or prevent potential impacts emanating from the proposed project are provided in Table 12-1 below.

**TABLE 12-1: ENVIRONMENTAL OBJECTIVES AND OUTCOMES**

Aspect	Environmental objective	Outcome
Geology	To prevent unacceptable mineral sterilisation.	Minimise the sterilisation of economic minerals as far as possible.
Topography	To minimise changes to natural topography.	Limit the alteration of the topography during mining and through rehabilitation.
Soil and land capability	To minimise the loss of soil resources and related land capability through physical disturbance, erosion, compaction and soil pollution.	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.	Limit the area of disturbance as far as practically possible.
Surface water	To prevent unacceptable alteration of drainage patterns.	Ensure that the reduction of the volume of runoff 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.
Groundwater	To prevent contamination of groundwater resources and related harm to water users	Ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes.
Air	To prevent air pollution health impacts.	Ensure that any pollutants emitted as a result of the project remains within acceptable limits so as to prevent health related impacts.
Noise	To prevent public exposure to disturbing noise.	Ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties.
Visual	To limit negative visual impacts.	Limit negative visual views.

Aspect	Environmental objective	Outcome
Traffic	To prevent transport related accidents and/or injury to people and livestock.	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.
Heritage and cultural	To minimise the disturbance of heritage resources.	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.	Work with existing structures and organisations to establish and maintain a good working relationship with surrounding communities, local authorities and landowners in order to limit the impacts associated with inward migration.  Enhance the positive economic impacts by working together with existing structures and organisations.
Land uses	To prevent unacceptable negative impacts on surrounding land uses.	Minimise the impact on land uses as little as possible in order to prevent unacceptable impacts on surrounding land uses and their economic activity.

### 12.1.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

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

- Alteration of natural drainage patterns;
- groundwater quality;
- Physical destruction and general disturbance of biodiversity;
- Air quality; and
- Noise levels.

Environmental impacts requiring monitoring are discussed future in Section 28.

### 12.1.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Section 3.2 and include:

- Site preparation;
- Earthworks;
- Waste rock disposal; and
- Continued use of approved facilities and activities.

### 12.1.3 MANAGEMENT ACTIONS

Management actions which will be implemented to control the project activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 26.



#### 12.1.4 ROLES AND RESPONSIBILITIES

The key personnel to ensure compliance to this EIR and EMPr are the operations executive and the Environmental Department Manager and officers. As a minimum, their roles, as they relate to the implementation of monitoring programmes and management activities, include:

- Ensuring that monitoring programmes and audits are scoped to be fit for purpose and included in the annual mine budget;
- Identifying and appointing appropriately qualified specialists/engineers to undertake the monitoring programmes;
- Appointing specialists in a timeous manner to ensure work can be carried out to acceptable standards;
- liaising with the relevant company, municipal and community structures in terms of the commitments in the Social and Labour Plan (SLP);
- Ensuring that commitments in the SLP are developed and implemented timeously;
- Establishing and maintaining good working relations with surrounding communities and landowners; and
- Facilitating stakeholder communication, information sharing and a grievance mechanism.

### **13 ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION**

Management actions including monitoring requirements, as outlined in Sections 26, should form part of the conditions of the environmental authorisation. With reference to Regulation 26 of GNR 982 of NEMA, additional conditions that should 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, LIMITATIONS AND GAPS IN KNOWLEDGE

Assumptions, uncertainties and limitations associated with the proposed project are included below. It is important to note that no assumptions and limitations were identified for:

- Soils and land capability
- Air and noise
- Surface water
- Visual
- Traffic
- Heritage/cultural and palaeontological resources
- Socio-economic.

### 14.1 ENVIRONMENTAL ASSESSMENT LIMIT

The EIA focuses on third parties only and does not assess health and safety impacts on employees and contractors because the assumption is made that these aspects are separately regulated by health and safety legislation, policies and standards, and that MMT 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, 2014), Synthetic Precipitation Leaching Procedure (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 runoff 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 Mamatwan in 2018 (NSS, 2018):

- The latest survey work was performed in winter when many fauna are less active or absent (due to migration).
- Some species may be present but are difficult to detect because e.g. they are subterranean, small, nocturnal, secretive and/or uncommon.

#### 14.5 GROUNDWATER

The following assumptions and limitations apply to the groundwater study undertaken for the proposed project (SLR, 2018):

- 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 scarce 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 MMTs, using their existing pits and did 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 (i.e. type and amounts of hazardous material released to the environment) used for groundwater modelling is considered to be conservative and may overestimate the potential pollution impacts. Further source term modelling should be carried out on waste samples collected from site and incorporated in the future groundwater model updates.

## 14.6 NOISE

It is assumed that activities during the survey on 3 December 2018 were representative of normal operational mining activities in the area.

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

### **15.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT**

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the biophysical 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 EMPr is effectively implemented there is no biophysical, social or economic reason why the project should not proceed.

### **15.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION**

#### **15.2.1 SPECIFIC CONDITIONS FOR INCLUSION IN THE EMPR**

Refer to Section 13.

#### **15.2.2 REHABILITATION REQUIREMENTS**

Refer to Section 1.

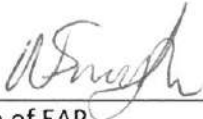
## 16 PERIOD FOR WHICH AUTHORISATION IS REQUIRED

It is anticipated that the Sinterfontein WRD extension would take place in 2 years.

## 17 UNDERTAKING

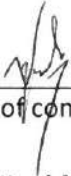
I, Natasha Smyth, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- The information provided herein is correct
- Comments and inputs from stakeholders and I&APs have been included and correctly recorded in this report
- Inputs and recommendations from the specialist reports have been included where relevant
- Any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time.



Signature of EAP

24/04/2019  
Date



Signature of commissioner of oath

26-04-2019  
Date

**OREN JAN VAN VREDE  
COMMISSIONER OF OATHS  
EX OFFICIO  
PROFESSIONAL  
ACCOUNTANT ( S.A. )**

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## 18 FINANCIAL PROVISION

### 18.1 METHOD TO DERIVE THE FINANCIAL PROVISION

A preliminary financial provision report has been prepared for the proposed project. This has been prepared in accordance with GNR 1147 of the National Environmental Management Act (107/1998): Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations, published 20 November 2015 (Financial Provisioning Regulations, 2015). A copy of the preliminary financial provision report is included in Appendix I.

The closure cost liability for the project was calculated as per the methodology of the DMR guideline document of January 2005 and inflated by the Consumer Price Index (CPI) to account for escalation since January 2005. As per the DMR guideline, MMT 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 1.

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

The amount required in order to manage and rehabilitate the environmental disturbance (as a result of MMT's activities) is provided for in the operating costs.

## 19 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

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

The impacts associated with socio-economic conditions are discussed in Appendix E. Management and management actions identified to address any socio-economic impacts are included in Section 26.

No person will be directly affected by the project given that no I&APs currently reside within the proposed extension footprint area. However, other direct impacts include:

- Road and traffic safety (**expected to be negligible**);
- 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 (**expected to be negligible**); and
- Employment and procurement of goods and services (**expected to be negligible**).

Indirect socio-economic impacts include:

- Alteration of drainage patterns by reducing the volume of runoff into the downstream catchments (**Insignificant**);
- Contamination of groundwater through long term seepage and/or runoff (**LOW** significance with and without mitigation);
- Contamination of surface water resources through long term seepage and/or runoff (**Insignificant**);
- Air pollution sources that can have a negative impact on ambient air quality (**LOW** significance with and without mitigation);
- Increase in disturbing noise levels (**Insignificant**); and
- Visual impacts on this receiving environment may be caused by activities and infrastructure (**Insignificant**).

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

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

## **20 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**

## 21 DETAILS OF THE EAP

The details of the EAPs who undertook the EIA process and prepared this EIR are provided in Part A, Section 1.

## 22 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

The activities that are covered in the EMP are included in Part A, Section 7.

## 23 COMPOSITE MAP

A composite map superimposed on the environmental sensitive areas of the preferred site is included in Appendix G.

## 24 DESCRIPTION OF THE IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENT

### 24.1 DETERMINATION OF CLOSURE OBJECTIVES

The closure objectives for the project were determined taking into account the existing type of environment as described in Section 7.4.1, 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 is provided in Section 27.1.1.

### 24.2 VOLUMES AND RATE OF WATER USE FOR MINING

This section is not applicable as the disposal of waste rock onto a WRD does not require the use of water.

### 24.3 HAS A WATER USE LICENCE BEEN APPLIED FOR?

South32 holds an amended IWUL (License number: 10/D41K/KAGJ/1537) issued by the DWS in January 2012. An amendment to the existing IWUL is required for the proposed project. In this regard the application for the WUL amendment will be submitted to the DWS. The water use that is being applied for as part of the proposed project is detailed in Section 3.1.

### 24.4 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The assessment of potential impacts is included in Section 9 and Appendix E. Management actions which will be implemented to avoid and minimise potential impacts are detailed in Section 26. The section below focuses on mitigation measures that are specific to listed activities based on the actions outlined in Section 26. It is important to note that management actions included in the Tshipi EMP (where relevant) that are also applicable to the MMT as part of filling the WRD void have been included in this report. In this regard, management actions that are also included in the Tshipi EMP are indicated in *italics*.



**TABLE 24-1: MEASURES TO REHABILITATE THE ENVIRONMENT AFFECTED BY THE UNDERTAKING OF ANY LISTED ACTIVITY**

Activity (Listed: NEMA and NEM:WA)		Phase	Size and scale of disturbance	Mitigation measures	Compliance with standards	Time period for implementation
Number	Description					
NEMA: Activity 27 of Listing Notice 1 (GNR 983)	The clearance of an area of 1 ha or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	Construction Operation Decommissioning Closure	Approximately 4 ha	<ul style="list-style-type: none"> <li>Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible;</li> <li>Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved;</li> <li>Limit land disturbance to those activities and areas that are described in the EMPr;</li> <li>Implement the soil conservation procedure as set out in Table 26 3;</li> <li>Establishment of short term perennial vegetation that will stabilise the site but allow the indigenous vegetation to establish over the site;</li> <li>Use existing established roads;</li> <li>Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, and in the designs of any permanent landforms;</li> <li>Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants are contained at source and do not pollute soils. In this regard: <ul style="list-style-type: none"> <li>Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps;</li> <li>Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;</li> <li>Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately;</li> <li>Implement and maintain a dirty water management system, as set out in the respective section;</li> <li>Implement the waste management practices, as set out in Table 26 2;</li> <li>Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and</li> <li>Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.</li> </ul> </li> <li>Implement the emergency response procedure in Section 29.2.2;</li> <li>Concurrent rehabilitation will take place as part of mining. The areas will be revegetated as soon as possible to limit dust and erosion. Vegetation that is local to the area will be established to limit the risk of erosion;</li> <li>While no protected plant or tree species were identified within the proposed project area, if any protected species are encountered, the necessary permits need to be obtained from the DAFF (tree permits) and DENC (Plant permits). If any active bird nests are observed within the proposed project footprint, the necessary permits need to be obtained from DENC prior to disturbance;</li> <li>Limit the WRD extension to the area specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to sensitive habitats and associated species;</li> <li>Clearly demarcate the boundary of all new footprint areas to limit the disturbance of adjacent undisturbed areas;</li> <li>Implement phased vegetation clearing of the WRD extension area, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities;</li> <li>Avoid unnecessary disturbance of natural areas by e.g. off-road driving;</li> <li>Keep dust levels within acceptable limits by periodically spraying roads and other exposed areas with water or an environmentally-friendly dust inhibitor;</li> <li>Commission a comprehensive Invasive Alien Plant Control Plan, and diligently implement it throughout the Life of Mine;</li> <li>Establish a log system (managed by the ECO) to record all observations of CI fauna, and all wildlife-related health and safety incidents (e.g. wildlife-traffic collisions, snake, scorpion and bee encounters, evidence of poaching activity, etc). The in situ abundance of African Rock Pipits should be monitored on a seasonal basis, and all areas with barking geckos should be logged and protected from disturbance;</li> <li>Monitor and maintain noise levels within accepted limits;</li> <li>Effectively rehabilitate disturbed areas post-operation, using (preferably local) indigenous flora. Rehabilitation material (e.g. mulch, seeds and seedlings) must be certified weed and alien free;</li> </ul>	<p>The management action to implement an alien invasive species programme is in accordance with the NEM:BA Alien and Invasive Species Regulations (2014) that requires the control of invasive species.</p> <p>Obtaining protected plant species in terms of the Northern Cape Nature Conservation Act, No. 9 of 2009, if necessary.</p> <p>Obtain protected tree permits from the National Forest Act No. 84 of 1998, if necessary.</p> <p>Construct, operate and maintain storm water management facilities in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA.</p> <p>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.</p> <p>Dust fallout monitoring will follow the ASTM D1739 (1970) method as required by the National Dust Control Regulations.</p> <p>Compliance with the National Heritage Resource Act, 1999 (No. 25 of 1999) in the event of any chance finds.</p>	<p>On-going</p> <p>As required</p> <p>On-going As required</p> <p>On-going As required</p> <p>On-going</p> <p>As required As required</p> <p>As required</p> <p>On-going On-going</p> <p>As required</p> <p>As required</p> <p>On-going On-going</p> <p>As required</p> <p>As required</p> <p>On-going As required</p>



Activity (Listed: NEMA and NEM:WA)		Phase	Size and scale of disturbance	Mitigation measures	Compliance with standards	Time period for implementation
Number	Description					
983)	licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding – (i) Where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (ii) The expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or (iii) The expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.			<ul style="list-style-type: none"> <li>Establishment of short term perennial vegetation that will stabilise the site but allow the indigenous vegetation to establish over the site;</li> <li>Use existing established roads;</li> <li>Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, and in the designs of any permanent landforms;</li> <li>Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants are contained at source and do not pollute soils. In this regard: <ul style="list-style-type: none"> <li>Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps;</li> <li>Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;</li> <li>Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately;</li> <li>Implement and maintain a dirty water management system, as set out in the respective section;</li> <li>Implement the waste management practices, as set out in Table 26-2;</li> <li>Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and</li> <li>Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.</li> </ul> </li> </ul>	<p>Alien and Invasive Species Regulations (2014) that requires the control of invasive species.</p> <p>Obtaining protected plant species in terms of the Northern Cape Nature Conservation Act, No. 9 of 2009, if necessary.</p> <p>Obtain protected tree permits from the National Forest Act No. 84 of 1998, if necessary.</p> <p>Construct, operate and maintain storm water management facilities in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA.</p>	<p>As required</p> <p>On-going</p> <p>As required</p> <p>On-going</p>
NEM:WA: Activity 13 in Category A (GNR 921)	The expansion of a waste management activity Listed in Category A or B of this Schedule, which does not trigger an additional waste management activity of this Schedule.	Construction Operation Decommissioning Closure	Approximately 4 ha	<ul style="list-style-type: none"> <li>Implement the emergency response procedure in Section 29.2.2;</li> <li>Concurrent rehabilitation will take place as part of mining. The areas will be revegetated as soon as possible to limit dust and erosion. Vegetation that is local to the area will be established to limit the risk of erosion;</li> <li>While no protected plant or tree species were identified within the proposed project area, if any protected species are encountered, the necessary permits need to be obtained from the DAFF (tree permits) and DENC (Plant permits). If any active bird nests are observed within the proposed project footprint, the necessary permits need to be obtained from DENC prior to disturbance;</li> <li>Limit the WRD extension to the area specifically identified and described in this EMP, with controlled access and zero tolerance of unnecessary disturbances to sensitive habitats and associated species;</li> <li>Clearly demarcate the boundary of all new footprint areas to limit the disturbance of adjacent undisturbed areas;</li> <li>Implement phased vegetation clearing of the WRD extension area, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities;</li> <li>Avoid unnecessary disturbance of natural areas by e.g. off-road driving;</li> <li>Keep dust levels within acceptable limits by periodically spraying roads and other exposed areas with water or an environmentally-friendly dust inhibitor;</li> <li>Commission a comprehensive Invasive Alien Plant Control Plan, and diligently implement it throughout the Life of Mine;</li> <li>Establish a log system (managed by the ECO) to record all observations of CI fauna, and all wildlife-related health and safety incidents (e.g. wildlife-traffic collisions, snake, scorpion and bee encounters, evidence of poaching activity, etc). The in situ abundance of African Rock Pipits should be monitored on a seasonal basis, and all areas with barking geckos should be logged and protected from disturbance;</li> <li>Monitor and maintain noise levels within accepted limits;</li> <li>Effectively rehabilitate disturbed areas post-operation, using (preferably local) indigenous flora. Rehabilitation material (e.g. mulch, seeds and seedlings) must be certified weed and alien free;</li> <li>Develop and implement an “after care” programme to manage rehabilitated areas which will aid in ensuring that the correct species are able to re-establish;</li> <li>Construct, operate and maintain mine infrastructure in a manner that ensures compliance with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include: <ul style="list-style-type: none"> <li>Separate clean and dirty water systems;</li> <li>Minimise the size and extent of dirty water areas; and</li> <li>Divert clean water (run-off and rainfall) around the mine/dirty areas and back into its normal flow paths in the environment.</li> </ul> </li> </ul>	<p>Submit a water use licence application for authorisation in terms of the NWA for dirty water containment facilities. Comply with the requirements of the WUL.</p> <p>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.</p> <p>Dust fallout monitoring will follow the ASTM D1739 (1970) method as required by the National Dust Control Regulations.</p> <p>Compliance with the National Heritage Resource Act, 1999 (No. 25 of 1999) in the event of any chance finds.</p>	<p>As required</p> <p>On-going</p> <p>As required</p> <p>On-going</p> <p>As required</p> <p>On-going</p> <p>As required</p> <p>On-going</p> <p>As required</p> <p>On-going</p> <p>As required</p> <p>On-going</p>

Activity (Listed: NEMA and NEM:WA)		Phase	Size and scale of disturbance	Mitigation measures	Compliance with standards	Time period for implementation
Number	Description					
				<ul style="list-style-type: none"> <li>Any dirty stormwater will be collected and pumped to the Adam's pit for re-use in the process;</li> <li>No contaminated water will be allowed to enter the natural hydrological system;</li> <li>Prevent contamination through appropriate infrastructure design. In this regard the WRD extension will be constructed according to recognised standards;</li> <li>Extend the existing stormwater management measures to include the extension to the WRD. Ensure the measures comply with R704 of the NWA;</li> <li>Manage WRD slope failures which could reduce the capacity of the WRD and/or reduce the effectiveness of WRD paddocks and berms. Rehabilitate any slope failures without delay and recover dislodged/displaced material and return to the WRD. This also applies to the paddocks and/or berms surrounding the WRD;</li> <li>Regularly review design measures and mitigation measures for identified impacts as per best practice requirements and in compliance with relevant authorisations, including the WUL;</li> <li>Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around the WRD indicate that this source is causing pollution which is migrating off-site;</li> <li>The full depth of available soils and subsoils will be placed on to the hard rock spoils, as far as is practical so as to limit ingress;</li> <li>The calcrete material will be placed over the hard rock spoils in order to facilitate the development of an aquiclude over the spoils;</li> <li>Immediately notify the DWS should any groundwater resource contamination be detected off-site;</li> <li>Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources indicate that these sources are causing pollution which is migrating off-site.</li> <li>Prevent pollution through appropriate infrastructure design. In this regard the WRD extension will be constructed according to approved designs;</li> <li>Re-run the groundwater model periodically during the operational phase as and when additional relevant data becomes available, in order to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, make for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning;</li> <li>Conduct further source term studies to be used for groundwater modelling updates;</li> <li>Monitor groundwater quality (refer to Section 28 for the monitoring programme). Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts;</li> <li>Fill waste rock in the void and avoid tipping waste rock from the crest of the existing WRD;</li> <li>Once the void is filled, dump waste rock on the WRD in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position;</li> <li>Use dust allaying measures, such as water sprays or equivalent controls to limit the generation of dust, at waste rock tipping points on the WRDs;</li> <li>Allow topsoil stockpiles and WRD side slopes to re-vegetate naturally. Should re-vegetation cover be insufficient after a rainy season, implement additional dust management measures, such as the use of geotextiles and wind breaks or other methods that are proven to be effective;</li> <li>General good housekeeping will be maintained in all areas prone for dust release. Regular inspection and maintenance routines will be implemented in areas to address spillage on ground, thereby preventing the re-suspension of settled dust;</li> <li>Maintain a complaints register that is available at the mine. The date and time noted on the complaints register will be the date and time that the reported problem is observed, not the date and time that the complaint is logged. Compare the complaints register to air quality monitoring data, as well as recorded meteorological data, to identify problem areas and then iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources;</li> <li>Continuous implementation of the dust monitoring programme as outlined in Section 28 of the main report. Report dustfall results annually to the District Municipality Air Quality officer.</li> <li>Maintain all diesel-powered earth moving equipment in order to limit noise, including the checking and replacement of exhaust and intake silencers;</li> <li>Maintain all haul roads in a good state of repair at all times to avoid unwanted rattle and "body-slap" from vehicles;</li> <li>Operate equipment in a proper manner with respect to minimising noise emissions, for example,</li> </ul>		<p>On-going</p> <p>On-going</p> <p>On-going</p> <p>On-going</p> <p>On-going</p> <p>As required</p> <p>As required</p> <p>On-going</p> <p>On-going</p> <p>As required</p> <p>As required</p> <p>On-going</p> <p>As required</p> <p>As required</p> <p>On-going</p> <p>On-going</p> <p>As required</p> <p>On-going</p> <p>On-going</p> <p>On-going</p> <p>On-going</p> <p>On-going</p> <p>On-going</p>

Activity (Listed: NEMA and NEM:WA)		Phase	Size and scale of disturbance	Mitigation measures	Compliance with standards	Time period for implementation
Number	Description					
				<p><i>minimisation of drop heights when loading and no un-necessary revving of engines;</i></p> <ul style="list-style-type: none"> <li>• <i>Record and respond immediately to complaints about disturbing noise. Document and recorded such complaints as incidents, and document the measures taken to address these. Keep these records for the life of mine;</i></li> <li>• <i>Undertake noise monitoring following the receipt of a complaint. Where necessary, implement additional management actions to avoid repeat occurrences;</i></li> <li>• <i>Noise monitoring will be undertaken on an annual basis in accordance with the SABS code 0103 in order to evaluate the impact of the mining. The target will be that adjacent residences should not experience more than a 5dBA increase over the background levels;</i></li> <li>• <i>Effectively rehabilitate the WRDs which is critical because these will be a permanent post closure features. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities;</i></li> <li>• <i>Ensure that all vegetation that is planted as part of rehabilitation will reflect the natural vegetation of the area, as far as is practicable;</i></li> <li>• <i>Shape any residual WRDs left on surface;</i></li> <li>• <i>Manage final rehabilitated areas and landforms remaining in perpetuity through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts;</i></li> <li>• <i>Consult a professionally registered heritage and/or palaeontological specialist to make associated recommendations that will be complied with prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance at the mine;</i></li> <li>• <i>Communicate with neighbouring land owners and users as required to facilitate information sharing and management of environmental impacts associated with the WRD extension.</i></li> </ul>		<p>As required</p> <p>As required</p> <p>As required</p> <p>As required</p> <p>As required</p> <p>As required</p> <p>As required</p> <p>As required</p> <p>On-going</p>

## 25 IMPACT MANAGEMENT OUTCOMES

Table 25-1 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 26.

**TABLE 25-1: DESCRIPTION OF IMPACT MANAGEMENT OUTCOMES**

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Loss and sterilisation of mineral resources	Geology	Construction Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to prevent unacceptable mineral sterilisation.</li> <li>The outcome is to minimise the sterilisation of economic minerals as far as possible.</li> </ul>
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Altering topography	Topography	Construction Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Control through management and design</li> <li>Control through rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to minimise changes to natural topography.</li> <li>The outcome is to limit the alteration of the topography during mining and through rehabilitation.</li> </ul>
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Loss of soil resources and land capability through physical disturbance and contamination	Soil and land capability	Construction Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Control through footprint disturbance limitation</li> <li>Control through waste management procedures</li> <li>Control through soil management procedures</li> <li>Control through rehabilitation</li> <li>Remedy through emergency response procedure (Section 29.2.2)</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to minimise the loss of soil resources and related land capability through physical disturbance, erosion, compaction and soil pollution.</li> <li>The outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.</li> </ul>
Site preparation Earthworks	Physical destruction and general	Biodiversity	Construction Operation	<ul style="list-style-type: none"> <li>Manage through concurrent rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to prevent the unacceptable disturbance and loss of</li> </ul>

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Waste rock disposal Rehabilitation of land forms Final land forms	disturbance of biodiversity		Decommissioning Closure	<ul style="list-style-type: none"> <li>Control through footprint limitation</li> <li>Manage through alien plant control plan</li> <li>Control through obtaining permits (if necessary)</li> <li>Remedy through emergency response procedure (Section 29.2.2)</li> </ul>	biodiversity and related ecosystem functionality through physical and general disturbance. <ul style="list-style-type: none"> <li>The outcome is to limit the area of disturbance as far as practically possible.</li> </ul>
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Alteration of natural drainage patterns	Surface water	Construction Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Manage through separation of clean and dirty water</li> <li>Control through prevention of dirty water entering natural environment</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to prevent unacceptable alteration of drainage patterns.</li> <li>The outcome is to ensure that the reduction of the volume of runoff 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.</li> </ul>
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Contamination of surface water		Construction Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Manage through infrastructure design</li> <li>Control through use of existing stormwater infrastructure</li> <li>Manage through monitoring (Section 28)</li> <li>Remedy through emergency response procedure (Section 29.2.2)</li> </ul>	
Waste rock disposal Rehabilitation of land forms Final land forms	Contamination of groundwater	Groundwater	Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Management through infrastructure design</li> <li>Manage through modelling and monitoring (Section 28)</li> <li>Remedy through emergency response procedure (Section</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to prevent contamination of groundwater resources and related harm to water users</li> <li>The outcome is to ensure groundwater quality remains within acceptable limits for both domestic and agricultural</li> </ul>

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
				29.2.2)	purposes.
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Air pollution	Air	Construction Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Control through dust suppression</li> <li>Manage through rehabilitation</li> <li>Manage through complaints response</li> <li>Manage through monitoring (Section 28)</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to prevent air pollution health impacts.</li> <li>The outcome is to ensure that any pollutants emitted as a result of the project remains within acceptable limits so as to prevent health related impacts.</li> </ul>
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Increase in disturbing noise levels	Noise	Construction Operation Decommissioning	<ul style="list-style-type: none"> <li>Manage through equipment maintenance</li> <li>Manage through proper equipment operation</li> <li>Manage through monitoring on receipt of noise complaint</li> <li>Manage through annual noise monitoring (Section 28)</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to prevent public exposure to disturbing noise.</li> <li>The outcome is to ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties.</li> </ul>
Waste rock disposal Rehabilitation of land forms Final land forms	Negative visual views	Visual	Operation Decommissioning Closure	<ul style="list-style-type: none"> <li>Manage through footprint limitation</li> <li>Manage through rehabilitation</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to limit negative visual impacts</li> <li>The outcome is to limit negative visual views</li> </ul>
Site preparation Earthworks Waste rock disposal	Loss of heritage/cultural and palaeontological resources	Heritage/cultural and palaeontological resources	Construction Operation	<ul style="list-style-type: none"> <li>Manage through change find procedure (Section 29.2.2)</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to minimise the disturbance of heritage resources.</li> <li>The outcome is 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.</li> </ul>
Site preparation	Land use	Change in land	Construction	<ul style="list-style-type: none"> <li>Manage through</li> </ul>	<ul style="list-style-type: none"> <li>The objective is to prevent unacceptable</li> </ul>



Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms		use	Operation Decommissioning Closure	communication structures <ul style="list-style-type: none"> <li>• Manage through rehabilitation</li> </ul>	negative impacts on surrounding land uses. <ul style="list-style-type: none"> <li>• The outcome is to prevent unacceptable negative impacts on surrounding land uses.</li> </ul>

## 26 IMPACT MANAGEMENT ACTIONS

Management actions identified to prevent, reduce, control or remedy the assessed impacts are presented in Table 26-1 below. 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 in the table below. It is important to note that management actions included in the Tshipi EMP (where relevant) that are also applicable to the MMT as part of filling the WRD void have been included in this report. In this regard, management actions that are also included in the Tshipi EMP are indicated in *italics*.

**TABLE 26-1: DESCRIPTION OF IMPACT MANAGEMENT ACTIONS**

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
Site preparation Earthworks Final rehabilitated land forms Final land forms	Altering topography	Implement the following management actions during all mine phases: <ul style="list-style-type: none"> <li><i>Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible; and</i></li> <li>Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved.</li> </ul>	On-going	Not applicable
Site preparation Earthworks Waste rock disposal Rehabilitation of final land forms Final land forms	Loss of soil resources and land capability through physical disturbance and contamination	Implement the following management actions during all mine phases: <ul style="list-style-type: none"> <li><i>Limit land disturbance to those activities and areas that are described in the EMPr;</i></li> <li><i>Implement the soil conservation procedure as set out in Table 26-3;</i></li> <li><i>Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved;</i></li> <li><i>Establishment of short term perennial vegetation that will stabilise the site but allow the indigenous vegetation to establish over the site;</i></li> <li><i>Use existing established roads;</i></li> <li><i>Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as</i></li> </ul>	On-going	Not applicable

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		<p><i>part of closure planning, and in the designs of any permanent landforms;</i></p> <ul style="list-style-type: none"> <li>• <i>Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants are contained at source and do not pollute soils. In this regard:</i> <ul style="list-style-type: none"> <li>○ <i>Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps;</i></li> <li>○ <i>Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;</i></li> <li>○ <i>Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately;</i></li> <li>○ <i>Implement and maintain a dirty water management system, as set out in the respective section;</i></li> <li>○ <i>Implement the waste management practices, as set out in Table 26-2;</i></li> <li>○ <i>Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and</i></li> <li>○ <i>Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.</i></li> </ul> </li> <li>• <i>Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures; and</i></li> <li>• <i>Implement the emergency response procedure in Section 29.2.2 in the event any major spillage incident.</i></li> </ul>		
Site	Physical destruction of	Implement the following management actions during all mine	On-going	The management action to implement an alien

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
preparation Earthworks Waste Rock disposal Rehabilitation of land forms Final land forms	biodiversity an general disturbance	<p>phases:</p> <ul style="list-style-type: none"> <li>• Concurrent rehabilitation will take place as part of mining. The areas will be revegetated as soon as possible to limit dust and erosion. Vegetation that is local to the area will be established to limit the risk of erosion;</li> <li>• While no protected plant or tree species were identified within the proposed project area, if any protected species are encountered, the necessary permits need to be obtained from the DAFF (tree permits) and DENC (Plant permits). If any active bird nests are observed within the proposed project footprint, the necessary permits need to be obtained from DENC prior to disturbance;</li> <li>• <i>Limit the WRD extension to the area specifically identified and described in this EMP, with controlled access and zero tolerance of unnecessary disturbances to sensitive habitats and associated species;</i></li> <li>• <i>Clearly demarcate the boundary of all new footprint areas to limit the disturbance of adjacent undisturbed areas;</i></li> <li>• <i>Implement phased vegetation clearing of the WRD extension area, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities;</i></li> <li>• <i>Avoid unnecessary disturbance of natural areas by e.g. off-road driving;</i></li> <li>• <i>Keep dust levels within acceptable limits by periodically spraying roads and other exposed areas with water or an environmentally-friendly dust inhibitor;</i></li> <li>• <i>Commission a comprehensive Invasive Alien Plant Control Plan, and diligently implement it throughout the Life of Mine;</i></li> <li>• <i>Establish a log system (managed by the ECO) to record all observations of CI fauna, and all wildlife-related health and safety incidents (e.g. wildlife-traffic collisions, snake, scorpion and bee encounters, evidence of poaching activity, etc). The in situ abundance of African Rock Pipits should be monitored on</i></li> </ul>		<p>invasive species programme is in accordance with the NEM:BA Alien and Invasive Species Regulations (2014) that requires the control of invasive species.</p> <p>Obtaining protected plant species in terms of the Northern Cape Nature Conservation Act, No. 9 of 2009, if necessary.</p> <p>Obtain protected tree permits from the National Forest Act No. 84 of 1998, if necessary.</p>

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		<p><i>a seasonal basis, and all areas with barking geckos should be logged and protected from disturbance.</i></p> <ul style="list-style-type: none"> <li>• <i>Monitor and maintain noise levels within accepted limits;</i></li> <li>• <i>Effectively rehabilitate disturbed areas post-operation, using (preferably local) indigenous flora. Rehabilitation material (e.g. mulch, seeds and seedlings) must be certified weed and alien free;</i></li> <li>• <i>Develop and implement an “after care” programme to manage rehabilitated areas which will aid in ensuring that the correct species are able to re-establish;</i></li> <li>• <i>Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, including in the designs of potentially polluting structures (mine residue facilities); and</i></li> <li>• <i>Implement the emergency response procedure in Section 29.2.2 in the event of a potentially contaminating incident.</i></li> </ul>		
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Alteration of natural drainage patterns	Implement the following management actions during all mine phases: <ul style="list-style-type: none"> <li>• <i>Construct, operate and maintain mine infrastructure in a manner that ensures compliance with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include:</i> <ul style="list-style-type: none"> <li>○ <i>Separate clean and dirty water systems;</i></li> <li>○ <i>Minimise the size and extent of dirty water areas; and</i></li> <li>○ <i>Divert clean water (run-off and rainfall) around the mine/dirty areas and back into its normal flow paths in the environment.</i></li> </ul> </li> <li>• Any dirty stormwater will be collected and pumped to the Adam's pit for re-use in the process; and</li> <li>• No contaminated water will be allowed to enter the natural hydrological system.</li> </ul>	On-going	Construct, operate and maintain storm water management facilities in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA.

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Contamination of surface water resources	Implement the following management actions during all mine phases: <ul style="list-style-type: none"> <li>• <i>Prevent contamination through appropriate infrastructure design. In this regard the WRD extension will be constructed according to recognised standards;</i></li> <li>• <i>Extend the existing stormwater management measures to include the extension to the WRD. Ensure the measures comply with R704 of the NWA;</i></li> <li>• <i>Manage WRD slope failures which could reduce the capacity of the WRD and/or reduce the effectiveness of WRD paddocks and berms. Rehabilitate any slope failures without delay and recover dislodged/displaced material and return to the WRD. This also applies to the paddocks and/or berms surrounding the WRD;</i></li> <li>• <i>Regularly review design measures and mitigation measures for identified impacts as per best practice requirements and in compliance with relevant authorisations, including the WUL;</i></li> <li>• <i>Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around the WRD indicate that this source is causing pollution which is migrating off-site; and</i></li> <li>• <i>Implement the emergency response procedure in Section 29.2.2 in the event of a potentially polluting discharge incident.</i></li> </ul>	On-going	Construct, operate and maintain storm water management facilities in in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA.
Waste rock disposal Rehabilitation of land forms Final land forms	Contamination of groundwater resources	Implement the following management actions the operational, decommissioning and closure phases: <ul style="list-style-type: none"> <li>• <i>The full depth of available soils and subsoils will be placed on to the hard rock spoils, as far as is practical so as to limit ingress.</i></li> <li>• <i>The calcrete material will be placed over the hard rock spoils in order to facilitate the development of an aquiclude over the spoils.</i></li> <li>• <i>Immediately notify the DWS should any groundwater resource contamination be detected off-site.</i></li> </ul>	On-going	Construct, operate and maintain storm water management facilities in in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA.  Submit a water use licence application for authorisation in terms of the NWA for dirty water containment facilities. Comply with the requirements of the WUL.

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		<ul style="list-style-type: none"> <li>• Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources indicate that these sources are causing pollution which is migrating off-site.</li> <li>• Prevent pollution through appropriate infrastructure design. In this regard the WRD extension will be constructed according to approved designs.</li> <li>• Re-run the groundwater model periodically during the operational phase as and when additional relevant data becomes available, in order to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, make for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning.</li> <li>• Conduct further source term studies to be used for groundwater modelling updates.</li> <li>• Monitor groundwater quality (refer to Section 28 for the monitoring programme). Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts; and</li> <li>• Implement the emergency response procedure in Section 29.2.2 in the event of a potentially polluting discharge incident.</li> </ul>		
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms Final land forms	Air pollution	Implement the following management actions during all mine phases: <ul style="list-style-type: none"> <li>• Fill waste rock in the void and avoid tipping waste rock from the crest of the existing WRD.</li> <li>• Once the void is filled, dump waste rock on the WRD in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position.</li> <li>• Use dust allaying measures, such as water sprays or equivalent controls to limit the generation of dust, at waste</li> </ul>	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.  <i>Dust fallout monitoring will follow the ASTM</i>

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		<p><i>rock tipping points on the WRDs.</i></p> <ul style="list-style-type: none"> <li>• <i>Allow topsoil stockpiles and WRD side slopes to re-vegetate naturally. Should re-vegetation cover be insufficient after a rainy season, implement additional dust management measures, such as the use of geotextiles and wind breaks or other methods that are proven to be effective.</i></li> <li>• <i>General good housekeeping will be maintained in all areas prone for dust release. Regular inspection and maintenance routines will be implemented in areas to address spillage on ground, thereby preventing the re-suspension of settled dust.</i></li> <li>• <i>Maintain a complaints register that is available at the mine. The date and time noted on the complaints register will be the date and time that the reported problem is observed, not the date and time that the complaint is logged. Compare the complaints register to air quality monitoring data, as well as recorded meteorological data, to identify problem areas and then iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources;</i></li> <li>• <i>Continuous implementation of the dust monitoring programme as outlined in Section 28 of the main report. Report dustfall results annually to the District Municipality Air Quality officer.</i></li> </ul>		<p><i>D1739 (1970) method as required by the National Dust Control Regulations.</i></p>
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms	Increase in disturbing noise levels	Implement the following management actions during all mine phases prior to closure: <ul style="list-style-type: none"> <li>• <i>Maintain all diesel-powered earth moving equipment in order to limit noise, including the checking and replacement of exhaust and intake silencers;</i></li> <li>• <i>Maintain all haul roads in a good state of repair at all times to avoid unwanted rattle and “body-slap” from vehicles;</i></li> <li>• <i>Operate equipment 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;</i></li> <li>• <i>Record and respond immediately to complaints about disturbing noise. Document and recorded such complaints as</i></li> </ul>	On-going	Not applicable



Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		<p><i>incidents, and document the measures taken to address these. Keep these records for the life of mine;</i></p> <ul style="list-style-type: none"> <li>• <i>Undertake noise monitoring following the receipt of a complaint. Where necessary, implement additional management actions to avoid repeat occurrences.</i></li> <li>• Noise monitoring will be undertaken on an annual basis in accordance with the SABS code 0103 in order to evaluate the impact of the mining. The target will be that adjacent residences should not experience more than a 5dBA increase over the background levels.</li> </ul>		

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
Waste rock disposal Rehabilitation of final land forms Final land forms	Negative visual views	Implement the following management actions during the operational, decommissioning and closure phases: <ul style="list-style-type: none"> <li>• <i>Clear and expose only the footprint area as defined by the approved layout in this EMP.</i></li> <li>• <i>Dust in the mine area to be controlled by means of water spraying.</i></li> <li>• <i>Effectively rehabilitate the WRDs which is critical because these will be a permanent post closure features. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities;</i></li> <li>• <i>Ensure that all vegetation that is planted as part of rehabilitation will reflect the natural vegetation of the area, as far as is practicable;</i></li> <li>• <i>Shape any residual WRDs left on surface; and</i></li> <li>• <i>Manage final rehabilitated areas and landforms remaining in perpetuity through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.</i></li> </ul>	On-going	Not applicable
Site preparation Earthworks Waste rock disposal	Loss of heritage/cultural and palaeontological resources	<ul style="list-style-type: none"> <li>• <i>Consult a professionally registered heritage and/or palaeontological specialist to make associated recommendations that will be complied with prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance at the mine.</i></li> <li>• <i>Implement the emergency response procedure (Section 29.2.2) if there are any chance finds of heritage/ cultural or paleontological sites.</i></li> </ul>	As required  As required	Compliance with the National Heritage Resource Act, 1999 (No. 25 of 1999) in the event of any chance finds.
Site preparation Earthworks Waste rock disposal Rehabilitation of land forms	Change in land use	The following management actions will be implemented in all phases: <ul style="list-style-type: none"> <li>• <i>Implement the mitigation measures as outlined in the EMP;</i></li> <li>• <i>Communicate with neighbouring land owners and users as required to facilitate information sharing and management of environmental impacts associated with the WRD extension; and</i></li> </ul>	On-going	Not applicable

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
Final land forms		<ul style="list-style-type: none"><li>Rehabilitate the overall site to provide for the post closure land use in accordance with the mine Closure Plan.</li></ul>		

The waste management and soil conservation procedures applicable to the MMT are included in and Table 26-2 and Table 26-3 below.

**TABLE 26-2: WASTE MANAGEMENT PROCEDURES FOR GENERAL AND HAZARDOUS WASTE**

Items to be considered		Intentions
General	Specific	
Classification and record keeping	General	<i>MMT's general and hazardous waste management procedure will cover the collection, storage, handling, transportation and disposal of waste to and from the mine. MMT will ensure that the responsible contractor(s) are made aware of these procedures.</i>
	Waste opportunity analysis	<i>In line with the Department of Water and Environmental Affairs' (DWEA) strategy to eliminate waste streams in the longer term, MMT 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.</i>
	Classification	<i>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.</i>
	Safety data sheets	<i>MMT will maintain, where required in terms of the regulations, the safety data sheets for hazardous waste (prepared in accordance with SANS 10234).</i>
	Inventory of wastes produced	<i>MMT will keep an accurate and up to date record of the waste that is generated, which records must reflect:</i> <ul style="list-style-type: none"> <li>• <i>The classification of the wastes;</i></li> <li>• <i>The quantity of each waste generated, expressed in tons or cubic metres per month;</i></li> <li>• <i>The quantities of each waste that has either been re-used, recycled, recovered, treated or disposed of; and</i></li> <li>• <i>By whom the waste was managed.</i></li> </ul>
	Labelling and inventory of waste produced	<i>Any container or storage impoundment holding waste must be labelled, or where labelling is not possible, records must be kept, reflecting:</i> <ul style="list-style-type: none"> <li>• <i>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</i></li> <li>• <i>The classification of the waste in terms of Regulation 4 once it has been completed (if required).</i></li> </ul>
	Disposal record	<i>Written evidence of safe disposal of waste will be kept.</i>
	Record keeping	<i>Records will be retained for a period of at least five (5) years and will be made available to the DWEA on request.</i>
Waste management	Collection points	<i>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.</i>
	Laydown/ salvage areas	<i>During construction, operations, decommissioning and closure, lay down areas for re-usable non-hazardous materials will be established.</i>
	General (Non-hazardous) waste	<i>Will be stored in designated skips and removed by an approved contractor for disposal at a licenced facility.</i>

Items to be considered		Intentions
General	Specific	
	Hazardous wastes	<i>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 disposed of in a licenced facility.</i>
	Used and/or spilled hydrocarbons such as oil and grease	<i>Used and/or spilt oil and grease will be collected in suitable containers at designated collection points. The designated 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.</i>  <i>Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection.</i>  <i>An approved subcontractor will remove oil from site.</i>
	Any soil polluted by a spill	<i>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 bio-remediation 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.</i>  <i>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.</i>
	Mixing of wastes	<i>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.</i>
Disposal	Offsite waste disposal facilities	<i>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.</i>  <i>Unless collected by the municipality, MMT 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.</i>  <i>Unless collected by the municipality, the mine must ensure that the disposal of their waste to landfill is in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of Section 7(1) of the NEM:WA.</i>
Waste transport	Contractor	<i>A qualified, reputable 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.</i>
Banned practices	Long-term stockpiling of waste	<i>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.</i>
	Burying of waste	<i>No wastes will be placed on site, other than non-hazardous building rubble disposed of onto WRDs or in the pit.</i>

**TABLE 26-3: SOIL CONSERVATION PROCEDURES**

Steps	Factors to consider	Detail
<i>Delineation of areas to be stripped</i>		<i>Stripping will only occur where soils are to be disturbed by activities that are described in the EMP, and where a clearly defined end rehabilitation use for the stripped soil has been identified.</i>
<i>Reference to biodiversity action plan</i>		<i>All requirements for moving and preserving fauna and flora according to the biodiversity action plan will be adhered to.</i>
<i>Stripping</i>	<i>Planning</i>	<p><i>Even though the MMT is situated in a semi-arid area, soil stripping will not commence or be continued directly after a significant rainfall event as this will drastically increase soil compaction. Soil will be allowed to dry out sufficiently and compaction is minimised.</i></p> <p><i>Wherever possible, stripping and replacing of soils will be done in a single action. This is both to reduce compaction and to increase the viability of the seed bank contained in the stripped surface soil horizons.</i></p> <p><i>All machines will be in efficient and safe working condition and only operated when ground conditions enable their maximum operating efficiency.</i></p> <p><i>Stripping will be conducted a suitable distance ahead of the placement of waste rock to avoid loss and contamination. As a norm, soil stripping should be kept within 3-9 months ahead of development, or between 50-100 m ahead of the active operations.</i></p>
	<i>Topsoil</i>	<i>A thickness of 150 cm of topsoil will be stripped.</i>
	<i>Soft and hardpan carbonate horizons</i>	<i>Soft and hardpan carbonate horizons (deeper than 150cm) will be stripped separately and not mixed with the A and B horizons.</i>
<i>Delineation of stockpiling areas</i>	<i>Location</i>	<i>Existing approved designated stockpiles areas will be utilised. No new stockpile areas will be created as part of the merging of the WRD's.</i>
	<i>Designation of the areas</i>	<i>All topsoil will be stockpiled in areas clearly demarcated on the infrastructure layout and should be defined as no-go areas.</i>
<i>Stockpile management</i>	<i>Vegetation establishment and erosion control</i>	<p><i>The upper material of topsoil does not have high nutrient values, and their primary value is due to the presence of seed bank. Tests will be conducted to determine if nutrients or fertilisers need to be added. These tests will be undertaken as and when required.</i></p> <p><i>Sampling and analysis of the placed topsoil will be carried out on an annual basis in order to determine the need for fertiliser application.</i></p> <p><i>Stockpiles will be examined after a reasonable rainy period/season, and then annually to determine whether vegetation has naturally established itself on the stockpiles. In the case of no or sparse vegetation establishment, geo-textiles or other methods will be used on the topsoil stockpiles to prevent wind erosion.</i></p>
	<i>Slope</i>	<i>The stockpile side slopes should be flat enough to promote vegetation growth and reduce runoff related erosion. In addition to this, the topsoil stockpiles need to be established on a gradual slope if possible. Should erosion be noted, the slopes should be stabilised with geotextiles or other appropriate methods.</i>
	<i>Waste</i>	<i>No waste material will be placed on the soil stockpiles.</i>
	<i>Vehicles</i>	<i>Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.</i>

Steps	Factors to consider	Detail
Management of disturbed land	Erosion control	To prevent the erosion of topsoil, management actions may include one or more of the following; vegetation, berms, soil traps, hessians and storm water diversions away from areas susceptible to erosion.
Rehabilitation of disturbed land: restoration of land capability	Minimise areas of disturbance	The activities of decommissioning contractors or employees will be restricted to the planned areas. Instructions must be included in contracts that will restrict decommissioning workers to the areas demarcated for decommissioning. In addition, compliance to these instructions must be monitored.
	Placement of soil	Areas to be rehabilitated should be ripped in order to reduce soil compaction. As a general rule, a minimum layer of 50 cm of topsoil must 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.
	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.

## 27 FINANCIAL PROVISION

### 27.1 DETERMINATION OF THE AMOUNT OF THE FINANCIAL PROVISION

#### 27.1.1 CLOSURE OBJECTIVES DESCRIPTION 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 contamination beyond the mine site by surface run-off, groundwater movement and wind 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.
- Rehabilitate the land to achieve an end use of wilderness to the extent reasonably possible;
- Shape the merged WRD to create a stable landform.

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 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.

#### 27.1.2 CONFIRMATION THAT CLOSURE OBJECTIVES HAVE BEEN CONSULTED WITH I&APS

The closure objectives are outlined in this report which will be made available to I&APs, including landowners for review and comment (Section 7.2).

To date no comments regarding the closure objectives (see Section 27.1.1) have been received from I&APs, including landowners (see Section 7.2 for the details of the public participation process).

#### 27.1.3 REHABILITATION PLAN

The scale and aerial extent of the main mining activities at closure is indicated on the site infrastructure plan (see Figure 7).



The following design criterion was adopted for the preliminary rehabilitation plan and includes the following:

- WRD will be shaped and rehabilitated. WRD side slopes to be confirmed through ongoing field trials.
- WRD will be capped with a minimum of 300 mm topsoil/growth medium material. Capping thickness to be confirmed through ongoing field trials
- WRD to be revegetated using a mix of indigenous grasses (i.e. dry seeding) and trees/shrubs (i.e. hand planting of seedlings). Vegetation species to be confirmed through ongoing field trials.
- Evaluate the risk of erosion for the merged WRD. Storm water management infrastructure to be confirmed through ongoing field trials.
- Erosion management measures and/or mitigation measures to be confirmed through ongoing field trials.
- Generally accepted closure methods have been used as the basis for determining the closure cost liability.

#### 27.1.4 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. The rehabilitation plan is in line with the minimum requirement of the EMPr.

#### 27.1.5 CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISION

The closure cost calculation for the life of the project amounts to **R 1 934 647.24 (inclusive of VAT)**. This provides a cost estimate for the Sinterfontien WRD extension only to support the Basic Assessment process for the proposed project. However this will be incorporated into the overall MMT mine closure plan and the annual financial provision updates. The detailed closure cost report is included in Appendix I.

#### 27.1.6 CONFIRMATION THAT THE FINANCIAL PROVISION WILL BE PROVIDED

The financial provision is provided in the form of a bank guarantee.

## 28 MECHANISMS FOR MONITORING COMPLIANCE AND PERFORMANCE AGAINST THE EMPR

Environmental impacts requiring monitoring are listed in Table 28-1 below. It is important to note that the monitoring programme below includes requirements as outlined in the Tshipi EMPr (SLR, 2019), indicated in *italics*, and approved MMT EMP (Jaws, 2005).

As a general approach, MMT will ensure that the monitoring programmes comprise the following:

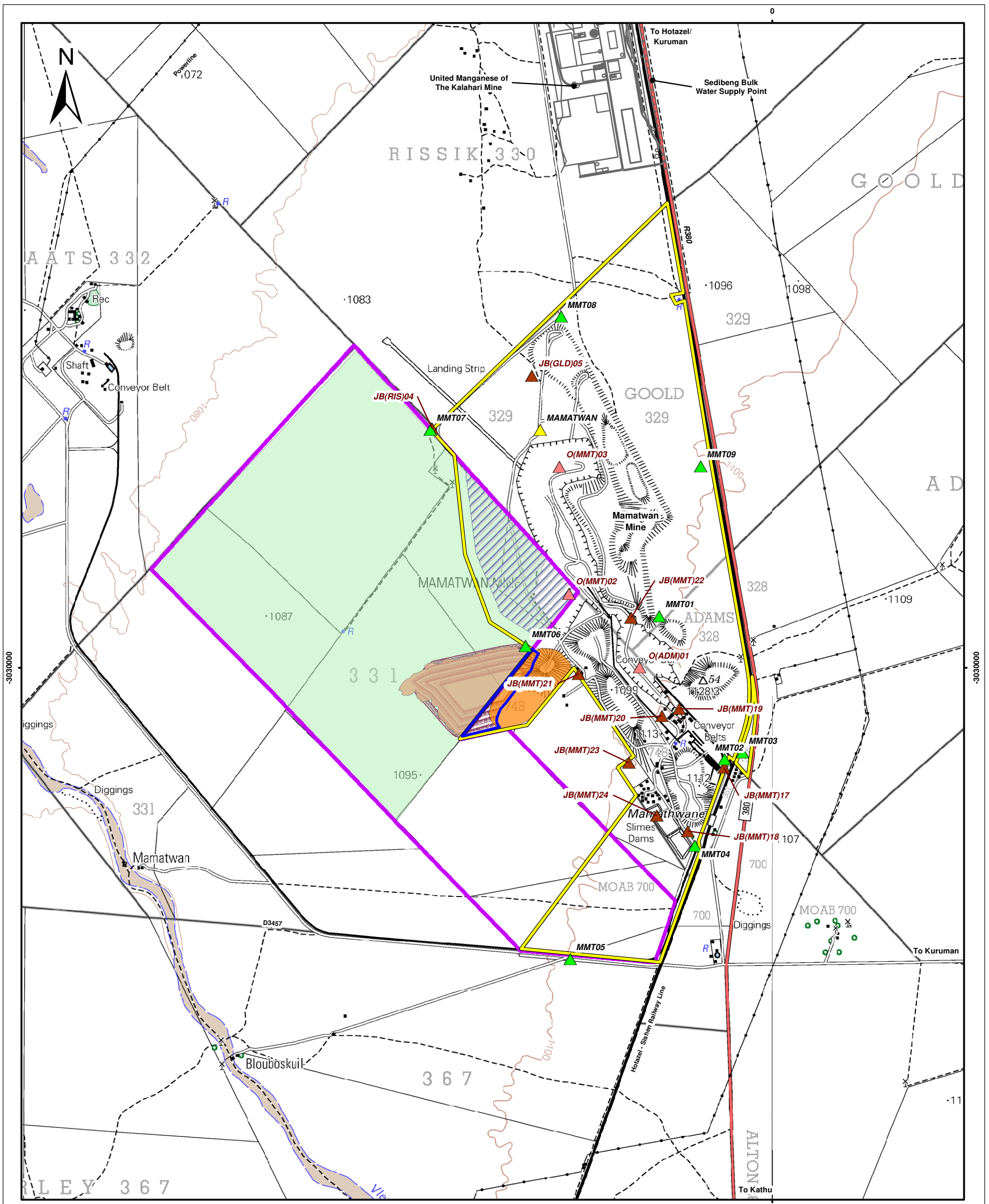
- Adherence to a formal monitoring procedure;
- Use of appropriately calibrated equipment by personnel trained to use the equipment;
- The preservation of samples according to laboratory specifications by personnel trained to use the equipment, where samples require analysis;
- The identification of monitoring parameters in consultation with a specialist in the relevant field and/or the relevant authority;
- The amendment of monitoring parameters, where necessary, following the initial monitoring results and in consultation with a specialist and/or the relevant authority; and
- The interpretation of data and reporting of trends will be undertaken by an appropriately qualified person.

**TABLE 28-1: MONITORING OF COMPLIANCE AND PERFORMANCE**

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions										
Earthworks Waste rock disposal Final rehabilitation of land forms Final land forms	Alteration of natural drainage patterns	So as to allow more informed management decisions at MMT regarding the volume of water used for specific purposes within the mine area, flow meters will be used within the distribution system.	Environmental Department	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 Waste rock disposal Final rehabilitation of land forms Final land forms	Contamination of groundwater resources	<p>Refer Figure 21 for the location of the groundwater monitoring points for both Tshipi and MMT.</p> <p>Water quality analyses results should be classified in terms of the South African National Standards 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 for are summarised in the table below.</p> <table border="1"> <tbody> <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<sub>3</sub></td></tr> <tr><td>Carbonate as CO<sub>3</sub></td></tr> <tr><td>Bicarbonate as HCO<sub>3</sub></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<sub>4</sub></td></tr> </tbody> </table>	pH	Conductivity in mS/m at 25 ° c	Total dissolved solids (TDS) at 180 ° c	Alkalinity as CaCO <sub>3</sub>	Carbonate as CO <sub>3</sub>	Bicarbonate as HCO <sub>3</sub>	Boron as B	Nitrate as N	Chloride as Cl	Sulphate as SO <sub>4</sub>	Environmental Department	<p>The MMT groundwater water quality monitoring to be undertaken on a monthly basis as per the requirements stipulated in the IWUL.</p> <p>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.</p>
pH														
Conductivity in mS/m at 25 ° c														
Total dissolved solids (TDS) at 180 ° c														
Alkalinity as CaCO <sub>3</sub>														
Carbonate as CO <sub>3</sub>														
Bicarbonate as HCO <sub>3</sub>														
Boron as B														
Nitrate as N														
Chloride as Cl														
Sulphate as SO <sub>4</sub>														

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions																	
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px;">Fluoride as F</td></tr> <tr><td style="padding: 2px;">Sodium as Na</td></tr> <tr><td style="padding: 2px;">Potassium as K</td></tr> <tr><td style="padding: 2px;">Calcium as Ca</td></tr> <tr><td style="padding: 2px;">Magnesium as Mg</td></tr> <tr><td style="padding: 2px;">Manganese as Mn</td></tr> <tr><td style="padding: 2px;">Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS)</td></tr> </table> <p style="margin-top: 10px;">The MMT approved EMP (JAWS, 2005) makes reference to the implementation of a monitoring programme, the report does not specify the location of monitoring points. It follows that the monitoring points included in Figure 21 are based on the specifications of the IWUL. Parameters that need to be monitored as outlined in the IWUL, are included in the table below.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px;">pH</td></tr> <tr><td style="padding: 2px;">Conductivity in mS/m at 25 ° c</td></tr> <tr><td style="padding: 2px;">Alkalinity as CaCO3</td></tr> <tr><td style="padding: 2px;">Nitrate as N</td></tr> <tr><td style="padding: 2px;">Chloride as Cl</td></tr> <tr><td style="padding: 2px;">Sulphate as SO4</td></tr> <tr><td style="padding: 2px;">Fluoride as F</td></tr> <tr><td style="padding: 2px;">Sodium as Na</td></tr> <tr><td style="padding: 2px;">Calcium as Ca</td></tr> <tr><td style="padding: 2px;">Magnesium as Mg</td></tr> </table>	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)	pH	Conductivity in mS/m at 25 ° c	Alkalinity as CaCO3	Nitrate as N	Chloride as Cl	Sulphate as SO4	Fluoride as F	Sodium as Na	Calcium as Ca	Magnesium as Mg		
Fluoride as F																					
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Chloride as Cl																					
Sulphate as SO4																					
Fluoride as F																					
Sodium as Na																					
Calcium as Ca																					
Magnesium as Mg																					
Site preparation Earthworks Waste rock disposal Final rehabilitation of	Physical destruction and general disturbance of biodiversity	The monitoring system currently used involves the use of satellite imagery and aerial photography, which are calibrated to the existing conditions on the ground through traditional vegetation sampling techniques. The satellite imagery estimates and quantifies the dynamics in vegetation cover and	Environmental Department	Monitoring will take place on an annual basis.																	

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
land forms Final land forms		health, while the aerial photography is used to monitor dynamics of the woody component in terms of bush encroachment crown cover, and also the amount of bare soil present. These techniques will be used to monitor the effects of mining on vegetation and the status of revegetation.		
Site preparation Earthworks Waste rock disposal Final rehabilitation of land forms Final land forms	Air pollution	<p>A dust fallout monitoring network needs to be implemented at the MMT. In this regard, the approved EMP (JAWS, 2005), does not specify where dust buckets need to be positioned. It follows that for the purpose of this report, dust fallout monitoring will be undertaken in accordance with existing practices. This includes nine single dust buckets within and around the MMT and one directional dust bucket. The location of the dust fallout buckets are illustrated in Figure 21.</p> <p><i>It is further recommended that Tshipi, UMK and MMT work together to establish and maintain an optimal monitoring network.</i></p>	Environmental Department	<p>Monitoring reports need to be uploaded onto the National Emissions Inventory System on annual basis.</p> <p>Dust fallout monitoring must be undertaken on a monthly basis for the duration of the mine.</p>
Site preparation Earthworks Waste disposal Rehabilitation of land forms	Increase in disturbing noise levels	<ul style="list-style-type: none"> <li>In the event that MMT receives noise related complaints MMT will 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.</li> <li>Aside from noise monitoring that is required to investigate any noise related complains, MMT will undertake annual noise monitoring in accordance with the SABS code 0103 in order to evaluate the impact of the mining. The target will be that adjacent residences should not experience more than a 5dBA increase over the background levels.</li> </ul>	Environmental Department with input from qualified specialist	If and when a complaint is raised and on an annual basis.

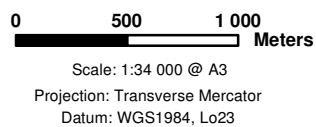


**Legend**

- Final Merged Waste Rock Dump
- Mamatwan Mining Right Area
- Sinterfontein Waste Rock Dump Void
- Mamatwan Sinterfontein Waste Rock Dump
- Tshipi Eastern Waste Rock Dump
- Boundary Pillar
- Tshipi Surface Use Area
- Tshipi Mining Right Area

**Monitoring Points**

- Mamatwan Monitoring Points
- Groundwater Monitoring Points
  - Pit Water Monitoring Points
  - Single Bucket Monitoring Stations
  - Dustwatch Monitoring Stations



Mamatwan Mining

**Figure 21**  
**Monitoring Programme**



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## 28.1 FREQUENCY OF PERFORMANCE ASSESSMENT REPORT

MMT will 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 will be undertaken by a qualified independent person and will comply with the relevant NEMA Regulations 2014 (as amended).

The environmental manager will conduct internal management audits against the commitments in the EMPr in accordance with an annual audit plan. During 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.

## 28.2 CLOSURE COST REPORTING

The financial provision for the mine will be updated on an annual basis and submitted to the DMR for the duration of the operation in accordance of the relevant legislation.

## 29 ENVIRONMENTAL AWARENESS PLAN

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

This section includes the environmental awareness plan for the MMT. The plan describes how employees are informed of:

- Environmental risks, which may result from their work and the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment;
- 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 MMT 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 MMT.

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 MMT to achieve the objectives of South32's sustainability policy.

#### 29.1.1 SUSTAINABILITY POLICY

South32's sustainability policy addresses both environmental and social needs. The contents of the policy is presented below.

“South32 affirms its purpose to make a difference by developing natural resources, improving people's lives now and for generations to come. South32 is committed to Sustainable Development, defined as supporting the needs of the present without compromising the ability of future generations to meet their own needs.

- We monitor the external environment for opportunities to invest and develop natural resources that deliver shared value for society.
- We work to achieve positive social, environmental and economic outcomes as a result of our decisions.
- We commit to respecting human rights in accordance with the UN Guiding Principles on Business and Human Rights in all of our stakeholder relationships. Our approach is guided by international human rights principles included in the Universal Declaration of Human Rights and other core international standards including the International Labour Organisation Declaration on Fundamental Principles and Rights at Work, the International Council for Mining and Metals Sustainable Development Framework and the Voluntary Principles on Security and Human Rights.
- We support employment and community practises which empower people to make choices and have control over their process of development as it affects their lives, beliefs, institutions, well-being and the lands they occupy or otherwise use.



- We identify and control risks, and continually improve our management of safety, health, environment and social impacts, through systematic management systems and processes.
- We practise responsible stewardship for the commodities we extract as well as the natural resources we consume.
- We develop and participate in conservation and rehabilitation activities to ensure ecosystems continue providing value to future generations.
- To meet the challenge of climate change, we work to reduce our greenhouse gas emissions. We continually assess our risks and opportunities to protect and create value, and monitor our impact to ensure we do not compromise the ecosystems which provide resilience against climate change for our host communities.
- We uphold stringent health, safety, environment, community and governance standards in all jurisdictions in which we operate.
- We publicly report our progress and encourage high standards of transparency and accountability in our business governance, risk and government interactions.”

### 29.1.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

MMT'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:
  - MMT will establish and appoint Managers at senior mine management level, 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 EMPr commitments;
    - Implementing and maintaining an environmental management system with the assistance of the appointed Environmental specialists, Superintendents and HSE Leads;
    - 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, specifically:
    - Discussions of environmental issues and feedback on environmental projects will form part of the annual work plan of the HSE committee who will report periodically to the board of the company;
    - Progress reports on the achievement of policy objectives and level of compliance with the approved EMPr will be provided to the DMR;
    - Ensuring environmental issues are raised at daily production meetings, monthly mine management meetings and all relevant mine wide meetings at all levels; and

- Ensuring environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties, where possible.
- Environmental awareness training:
  - MMT 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;
    - 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 identified in the EMPr;
- Design the mine to minimise the impact on the environment and to accomplish closure/rehabilitation objectives; and
- Maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

### 29.1.3 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 communicates:

- 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.

#### 29.1.3.1 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:

- 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.
- General training plan applicable to all personnel:
  - General understanding of the environmental setting of the mine (e.g. third party receptors 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;
- Identifying poor environmental management and stopping work which presents significant risks; and
- Reporting incidents.
- Specific training plan:
  - Specific environmental aspects and impacts 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).
- MMT's duty of care (specifically with respect to waste management); and

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 MMT will:

- Promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine and toolbox talks.
- Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Harbour Week, World Environment Day and National Water Week.

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

### 29.2.1 ON-GOING MONITORING AND MANAGEMENT ACTIONS

The monitoring programme as described in Section 28 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

### 29.2.2 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 employees/contractors, the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). In case of environmental emergencies MMT will comply with South32's Crisis and Emergency Management procedure (see Appendix H). In addition MMT will implement and the general and activity-specific procedures described in the sections below.

### 29.2.2.1 GENERAL EMERGENCY PROCEDURE

For all environmental emergencies, MMT will:

- Cordon off the area to prevent unauthorised access and tampering of evidence;
- Undertake actions defined in the emergency plan to limit/contain the impact of the emergency;
- If residue facilities/dams, storm water diversions, etc. are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available);
- Take photographs and samples as necessary to assist in investigation;
- Ensure compliance with Section 30 of the NEMA such that:
  - the Environmental specialists, Superintendents and HSE Leads must immediately notify the Director-General (DWS, 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 HSE 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 HSE 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.

### 29.2.2.2 IDENTIFICATION OF EMERGENCY SITUATIONS

The project specific emergency situations that have been identified together with specific emergency response procedures are outlined in Table 29-1.

**TABLE 29-1: EMERGENCY RESPONSE PROCEDURES**

Item	Emergency situation	Response in addition to general procedures
1	Spillage of chemicals, engineering substances and waste	<ul style="list-style-type: none"> <li>• Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, MMT will:               <ul style="list-style-type: none"> <li>○ Notify residents/users downstream of the pollution incident;</li> <li>○ Identify and provide alternative resources should contamination impact adversely on the existing environment;</li> <li>○ Cut off the source if the spill is originating from a pump, pipeline or valve (e.g. refuelling bays) and the infrastructure 'made safe';</li> <li>○ Contain the spill (e.g. construct temporary earth bund around source such as road tanker);</li> <li>○ Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal; and</li> <li>○ Remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.</li> </ul> </li> </ul>
2	Discharge of dirty water to the environment	<ul style="list-style-type: none"> <li>• Apply the principals listed for Item 1 above.</li> <li>• To stop spillage from the dirty water system the mine will:               <ul style="list-style-type: none"> <li>○ Redirect excess water to other dirty water facilities where possible;</li> <li>○ Pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system;</li> <li>○ Carry out an emergency discharge of clean water and redirect the spillage to the emptied facility; and</li> <li>○ Apply for emergency discharge as a last resort.</li> </ul> </li> </ul>
3	Pollution of surface water (where relevant)	<ul style="list-style-type: none"> <li>• Apply the principals listed for Item 1 above.</li> <li>• Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants.</li> <li>• Contamination entering the surface water drainage system will be redirected into the dirty water system.</li> <li>• The Environment department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.</li> </ul>
4	Groundwater contamination	<ul style="list-style-type: none"> <li>• 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).</li> </ul>

Item	Emergency situation	Response in addition to general procedures
		<ul style="list-style-type: none"> <li>Investigate the source of contamination and implement control/management actions.</li> </ul>
5	Flooding from failure of surface water control infrastructure	<ul style="list-style-type: none"> <li>Evacuate the area downstream of the failure.</li> <li>Using the emergency response team, rescue/recover and medically treat any injured personnel.</li> <li>Temporarily reinstate/repair storm water diversions during the storm event (e.g. emergency supply of sandbags).</li> <li>Close the roads affected by localised flooding or where a storm water surge has destroyed crossings/bridges.</li> </ul>
6	Uncovering of graves and sites and fossils	<ul style="list-style-type: none"> <li>Personnel discovering a grave or site will inform the environment department immediately and all work in the vicinity will be stopped immediately.</li> <li>The environmental department will 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 will resume in this area without the permission from the Environmental Control Officer (ECO) and SAHRA.</li> <li>If the newly discovered heritage resource is considered significant a Phase 2 assessment may be required.</li> <li>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 will be contacted.</li> <li>Should further burial grounds, graves or graveyards be found, the SAHRA Burial Grounds and Graves Unit will be contacted.</li> <li>Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves will 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.</li> <li>The exhumation process will comply with the requirements of the relevant Ordinance on Exhumations and the Human Tissues Act, 1983 (No. 65 of 1983).</li> </ul>

### 29.2.3 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;
- The mine will maintain an environmental management system where all operations 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.



### 30 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

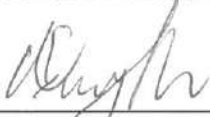
The following documents will be submitted to the DMR from the start of construction until mine closure:

- As noted in Section 28.1, an environmental audit report, prepared by an independent person, will be submitted 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.

### 31 UNDERTAKING

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

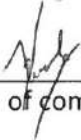
- The information provided herein is correct;
- Comments and inputs from stakeholders and I&APs have been included and correctly recorded in this report;
- Inputs and recommendations from the specialist reports have been included where relevant; and
- Any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time.



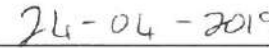
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Signature of EAP



\_\_\_\_\_  
Date



\_\_\_\_\_  
Signature of commissioner of oath



\_\_\_\_\_  
Date

**OREN JAN VAN VREDE  
COMMISSIONER OF OATHS  
EX OFFICIO  
PROFESSIONAL  
ACCOUNTANT (S.A.)**

**FOURWAYS MANOR OFFICE PARK  
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## 32 REFERENCES

Airshed Planning Professionals (Pty) Ltd. 2018a. Tshipi Borwa Manganese Mine Environmental Management Programme: Air Quality Specialist Study. Report No.: 16SLR24. May 2018.

Airshed Planning Professionals (Pty) Ltd, 2018b, Noise Survey Report for the December 2018 Sampling campaign conducted during crushing and train loading at the Tshipi Borwa Mine.

GHT Consulting Scientists (GHT). 2018. Geohydrological Report for MMT, 2018. Report No. RVN823.1/1858. August 2018.

Jones and Wagener, 2018, Mamatwan Manganese Mine, Conceptual Rehabilitation Design Report.

Joe Morolong Local Municipality. 2016. Integrated Development Plan. 2016.

Natural Scientific Services (NSS). 2018. Biodiversity Assessment for MMT, Northern Cape. Ref. No. 2433. July 2018.

PGS Heritage (PGS). 2018. Tshipi Borwa Mine WRD Project, on the Remaining Extent of Portion 8 & Portions 16-18 of the Farm Mamatwan 331 and the Remaining Extent of the Farm Moab 700, John Taolo Gaetsewe District Municipality, Northern Cape Province.

PGS Heritage (PGS). 2019. Request for exemption from a heritage impact study: MMT WRD extension, Hotazel, Joe Morolong local municipality, Northern Cape Province. February 2019.

Siyazi Transportation Services Limpopo. 2017. Tshipi Borwa Mine EMP Amendment to Cater for Infrastructure Layout Changes Northern Cape Province - Traffic Impact Assessment. June 2017.

SLR Consulting (Africa) (Pty) Ltd. 2014. Tshipi Borwa Mine Geochemical and Groundwater assessment, March 2014.

SLR Consulting (South Africa) (Pty) Ltd. 2018. Stormwater Management and Water Balance Update for Environmental Management Programme. June 2018

SLR Consulting (Africa) (Pty) Ltd. 2017. Tshipi Borwa Mine Groundwater study. July 2017.

SLR Consulting (South Africa) (Pty) Ltd. 2018. Tshipi Borwa EMP Groundwater Study. June 2018.

SLR Consulting (Africa) (Pty) Ltd. 2019. Environmental Impact Report for the Tshipi Borwa WRD extension project. March 2019.

SGS. 2019. Hotazel Manganese Mine (Mamatwan/Wessels) Annual Dust Deposition Monitoring January – December 2018. Reference: EN 230. February 2019.

Terra Africa Consult CC. 2018. Soil, land use and land capability report for the proposed Tshipi Borwa WRD Extension Project. June 2018.

## APPENDIX A: EXISTING AUTHORISATIONS

## **APPENDIX B: EAP CURRICULUM VITAE AND REGISTRATION**

## APPENDIX C: STAKEHOLDER ENGAGEMENT

- DMR pre-application meeting minutes (01 February 2019).
- Proof of pre-application liaison with the DWS.
- Copy of the NEMA/NEM:WA application form.
- Correspondence with the land claims commissioner.
- Background Information Document (BID) and proof of distribution.
- Copy of site notice including photographic record and map illustrating the location of the site notices.
- Advertisements placed in the Kalahari Bulletin and the Kathu Gazette.
- Correspondence from I&APs and commenting authorities.
- Public involvement database.
- Public meeting record – 16 April 2019.
- Commenting authorities meeting record – 16 April 2019.

## APPENDIX D: COMMERCIAL AGREEMENT



## APPENDIX E: DETAILED ASSESSMENT OF POTENTIAL IMPACTS

## DETAILED ASSESSMENT OF POTENTIAL IMPACTS

Potential environmental and socio-economic impacts were identified by SLR and stakeholders. All identified impacts were considered both incrementally and cumulatively in the context of the existing and approved MMT mining infrastructure and activities. In terms of the cumulative impact, this is considered to be insignificant in the context of the mining infrastructure and activities associated with both the MMT and Tshipi Borwa Mine and as such the assessment below focusses on the incremental impact only. The criteria used to rate each impact is outlined in Section 7.6.

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 provided in Section 9 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. Due to the nature of the proposed project and the collaboration between MMT and Tshipi, commitments from the Tshipi EMPr for the filling of the void are included in this BAR to ensure that the EMPr commitments for both parties are aligned. In this regard, management actions that are also included in the Tshipi EMPr (where relevant) are indicated in *italics*. A summary of the management actions is provided in Section 26 of this report.

## GEOLOGY

### ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCES

Information in this section was sourced from the project team.

### MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
Earthworks	Waste rock disposal	Rehabilitation of land forms	Final land forms

## DISCUSSION

Mineral resources can become sterilised through the placement of surface infrastructure and waste. The proposed WRD extension could present the potential for sterilisation of mineral resources. The WRD extension is located centrally between the existing Tshipi and Mamatwan mining operations. No sterilisation of mineral resources is expected. This impact has therefore been rated as being **INSIGNIFICANT**.

## TOPOGRAPHY

### ISSUE: ALTERING TOPOGRAPHY

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

#### MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks	Waste rock disposal	Rehabilitation of land forms	Final land forms

### DISCUSSION

The natural topography at the MMT has been disturbed as a result of the existing mining infrastructure and activities. The establishment of the proposed WRD extension will further alter natural topography and cannot be mitigated. It is however important to note that the WRD extension is located centrally between the existing Tshipi and Mamatwan mining operations. Any potential alteration of topography is expected to be negligible. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below are required to ensure this rating is achieved.

### MANAGEMENT OBJECTIVES

The objective is to minimise changes to natural topography.

### MANAGEMENT ACTIONS

Implement the following management actions during all mine phases:

- *Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible; and*
- Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved.

## SOIL AND LAND CAPABILITY

### ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE AND CONTAMINATION

Information in this section was sourced from the soil, land use and land capability study undertaken for the adjacent Tshipi Borwa Mine (Terra Africa, 2018).

#### MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks	Waste rock disposal	Rehabilitation of final land forms	Final land forms

## DISCUSSION

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 WRD extension will occupy a relatively small area of 4 ha, located centrally between the existing Tshipi and Mamatwan mining operations. The soil resources in the proposed WRD extension footprint has already been influenced by anthropogenic activities (witbank soil forms) to the extent that the land use options as well as performance of the soil to support vegetation has been affected. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below are required to ensure this rating is achieved.

## MANAGEMENT OBJECTIVE

The objective is to minimise the loss of soil resources and related land capability from physical disturbance, erosion, compaction and soil pollution.

## MANAGEMENT ACTIONS

Implement the following management actions during all mine phases:

- *Limit land disturbance to those activities and areas that are described in the EMPr.*
- *Implement the soil conservation procedure as set out in Table 26-3;*
- *Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved;*
- *Establishment of short term perennial vegetation that will stabilise the site but allow the indigenous vegetation to establish over the site.*
- *Use existing established roads;*
- *Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, and in the designs of any permanent landforms*
- *Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants are contained at source and do not pollute soils. In this regard:*
  - *Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps;*
  - *Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;*
  - *Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately;*
  - *Implement and maintain a dirty water management system, as set out in the respective section;*
  - *Implement the waste management practices, as set out in Table 26-2;*

- *Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and*
- *Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.*
- *Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures; and*
- *Implement the emergency response procedure in Section 29.2.2 in the event any major spillage incident.*

## BIODIVERSITY

### ISSUE: PHYSICAL DESTRUCTION AND GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section is informed by the biodiversity study undertaken for Mamatwan in 2018 (NSS, 2018).

### INTRODUCTION

The development of the proposed WRD extension has the potential to destroy or disturb biodiversity in the broadest sense, particularly in the unmitigated scenario. This will present a final land form that may have pollution potential through long term seepage and/or runoff.

### MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks	Waste rock disposal	Rehabilitation of land forms	Final land forms

### RATING OF IMPACT

#### **Severity/nature**

Areas of ecological sensitivity include functioning biodiversity areas with species diversity (including protected species) and associated intrinsic value. Linkages between these 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 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. It should however be noted that the proposed WRD extension is located centrally, adjacent to and within existing MMT and Tshipi Borwa Mine mining activities which has influenced the condition of naturally occurring vegetation. Although floral and faunal species of conservation concern occur or have the potential to occur within the broader study area, none of these were noted in the area where the WRD extension is proposed. The proposed footprint is located within an area rated by the biodiversity specialist to have moderate-low sensitivity. From a biodiversity perspective moderate-low sensitive areas may be disturbed with minimal mitigation.

In addition to the loss of habitat, with specific reference to the WRD extension, biodiversity may be disturbed in the following ways:

- Excessive dust fallout would have adverse effects on the growth of vegetation downwind of the WRD, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation;
- Noise and vibration (from vehicle movement, materials handling) may scare off vertebrates and invertebrates;
- Vegetation clearing activities will create an ideal scenario for the proliferation of alien invasive plant species, especially on the side slopes of the WRD; and
- An increase in pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

When considering the above and the relatively small footprint of the WRD extension (approximately 4 ha), the severity is rated as low in both the unmitigated and mitigated scenarios.

**Duration**

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, the WRD would be rehabilitated using naturally occurring plant species.

**Spatial scale / extent**

Given that biodiversity processes are not confined to the project 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.

**Consequence**

In the unmitigated scenario the consequence is medium and reduces to low with management actions.

**Probability**

Without management actions, impacts on biodiversity are possible. With management actions, the probability may be reduced with concurrent and effective rehabilitation.

**Significance**

The significance of the potential incremental impact associated with the extension of the WRD is rated **MEDIUM** without management actions, reducing to **LOW** with concurrent and effective rehabilitation.

**UNMITIGATED – SUMMARY OF THE RATED INCREMENTAL LOSS OF BIODIVERSITY THROUGH PHYSICAL DESTRUCTION AND GENERAL DISTURBANCE IMPACT PER PHASE OF THE MINE**

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated	L	H	M	M	M	<b>M</b>

**MITIGATED – SUMMARY OF THE RATED INCREMENTAL LOSS OF BIODIVERSITY THROUGH PHYSICAL DESTRUCTION AND GENERAL DISTURBANCE IMPACT PER PHASE OF THE MINE**

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

**MANAGEMENT OBJECTIVE**

The objective is to prevent the unacceptable loss and disturbance of biodiversity, species of conservation concern and related ecosystem functionality through physical disturbance.

**MANAGEMENT ACTIONS**

Implement the following management actions during all phases:

- Concurrent rehabilitation will take place as part of mining. The areas will be revegetated as soon as possible to limit dust and erosion. Vegetation that is local to the area will be established to limit the risk of erosion;
- While no protected plant or tree species were identified within the proposed project area, if any protected species are encountered, the necessary permits need to be obtained from the DAFF (tree permits) and DENC (Plant permits). If any active bird nests are observed within the proposed project footprint, the necessary permits need to be obtained from DENC prior to disturbance;
- *Limit the WRD extension to the area specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to sensitive habitats and associated species;*
- *Clearly demarcate the boundary of all new footprint areas to limit the disturbance of adjacent undisturbed areas;*
- *Implement phased vegetation clearing of the WRD extension area, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities;*
- *Avoid unnecessary disturbance of natural areas by e.g. off-road driving;*
- *Keep dust levels within acceptable limits by periodically spraying roads and other exposed areas with water or an environmentally-friendly dust inhibitor;*
- *Commission a comprehensive Invasive Alien Plant Control Plan, and diligently implement it throughout the Life of Mine;*
- *Establish a log system (managed by the ECO) to record all observations of CI fauna, and all wildlife-related health and safety incidents (e.g. wildlife-traffic collisions, snake, scorpion and bee encounters, evidence of poaching activity, etc). The in situ abundance of African Rock Pipits should be monitored on a seasonal basis, and all areas with barking geckos should be logged and protected from disturbance.*
- *Monitor and maintain noise levels within accepted limits;*

- Effectively rehabilitate disturbed areas post-operation, using (preferably local) indigenous flora. Rehabilitation material (e.g. mulch, seeds and seedlings) must be certified weed and alien free;
- Develop and implement an “after care” programme to manage rehabilitated areas which will aid in ensuring that the correct species are able to re-establish;
- Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, including in the designs of potentially polluting structures (mine residue facilities); and
- Implement the emergency response procedure in Section 29.2.2 in the event of a potentially contaminating incident.

## SURFACE WATER

### ISSUES: ALTERATION OF NATURAL DRAINAGE PATTERNS

#### MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
Earthworks	Waste rock disposal	Rehabilitation of land forms	Final land forms

### DISCUSSION

Natural drainage across the project area is via sheet flow. Drainage patterns have been altered by existing approved mining activities. The extension of the WRD will require an adaptation of existing stormwater management measures in order to contain dirty water in compliance with R704 of the NWA. Stormwater management measures will be in place until such time as the WRD extension is rehabilitated. The WRD extension will occupy a relatively small area of 4 ha, located centrally between the existing Tshipi and Mamatwan mining operations. Any potential loss of runoff to the catchment is expected to be negligible. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below are required to ensure this rating is achieved.

### MANAGEMENT OBJECTIVE

The objective is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow or to minimise where this could not be prevented.

### MANAGEMENT ACTIONS

Implement the following management actions during all mine phases:

- Construct, operate and maintain mine infrastructure in a manner that ensures compliance with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include:
  - Separate clean and dirty water systems;
  - Minimise the size and extent of dirty water areas; and
  - Divert clean water (run-off and rainfall) around the mine/dirty areas and back into its normal flow paths in the environment.



- Any dirty stormwater will be collected and pumped to the Adam's pit for re-use in the process; and
- No contaminated water will be allowed to enter the natural hydrological system.

## ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES

### MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
Earthworks	Waste rock disposal	Rehabilitation of land forms	Final land forms

## DISCUSSION

The proposed WRD extension presents a potential long-term contamination source to surface water through seepage reaching the baseflow of rivers and runoff from the side slopes of the WRD reaching the nearest drainage lines. However, given that the WRD extension is located centrally between the existing Tshipi and Mamatwan mining operations, the nearest drainage lines to the WRD extension are between 3 km (the ephemeral Vlermuisleegte River) and 6 km (the ephemeral Witleegte River) away, and the WRD extension will be designed with stormwater management measures that comply with R704 of the NWA, it is considered highly unlikely that any potential seepage or runoff from the WRD extension would reach drainage lines in the vicinity of the mine. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below are required to ensure this rating is achieved.

## MANAGEMENT OBJECTIVE

The objective is to prevent pollution of surface water resources.

## MANAGEMENT ACTIONS

Implement the following management actions during all mine phases:

- *Prevent contamination through appropriate infrastructure design. In this regard the WRD extension will be constructed according to recognised standards;*
- *Extend the existing stormwater management measures to include the extension to the WRD. Ensure the measures comply with R704 of the NWA;*
- *Manage WRD slope failures which could reduce the capacity of the WRD and/or reduce the effectiveness of WRD paddocks and berms. Rehabilitate any slope failures without delay and recover dislodged/displaced material and return to the WRD. This also applies to the paddocks and/or berms surrounding the WRD;*
- *Regularly review design measures and mitigation measures for identified impacts as per best practice requirements and in compliance with relevant authorisations, including the WUL;*
- *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around the WRD indicate that this source is causing pollution which is migrating off-site; and*
- *Implement the emergency response procedure in Section 29.2.2 in the event of a potentially polluting discharge incident.*

## GROUNDWATER

### ISSUE: CONTAMINATION OF GROUNDWATER RESOURCES

Information in this section is informed by the updated groundwater study completed for MMT in 2018 (GHT, 2018) and the groundwater modelling completed for the East WRD at the adjacent Tshipi Borwa Mine (SLR, 2018). The extension of the MMT WRD will result in the merging of Tshipi's East WRD and the MMT Sinterfontein WRD. Therefore the outcomes of the modelling completed for the Tshipi Borwa Mine is considered relevant to the MMT WRD extension.

### INTRODUCTION

The proposed WRD extension presents a potential long-term contamination source to groundwater and is expected to be a permanent structure at the mine.

### MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
N/A			
-	Waste rock disposal	Rehabilitation of land forms	Final land forms

### RATING OF IMPACTS

#### **Severity / nature**

The 2018 groundwater study indicated that existing waste rock facilities at MMT have resulted in localised groundwater quality impacts (and specifically salts – Na, Ca, Mg and SO<sub>4</sub>). The study further indicated that there is no potential for contamination of existing natural surface water resources and limited risk of run-off spreading contaminants across the site surface due to the high permeability of surface aeolian deposits (GHT, 2018).

The proposed WRD extension was modelled using an unlined and lined scenario for a period of 100 years (Figure 22). The unlined scenario (unmitigated) modelled the current situation where the WRDs on site are not lined. The lined scenario (mitigated) modelled a Class A type barrier (as the waste rock classifies as a Type 1 waste) in which any seepage from the waste facility is avoided. A very low hydraulic conductivity was assumed for the area under the WRD in this scenario. A chloride source concentration of 2 200 mg/ℓ was simulated for the contamination source. The modelling predicted that a plume of low contamination would extend outside of the Mamatwan Mining Right area into the Tshipi Mining Right area. No third party boreholes fall within the predicted contamination plume. The key contributing factors include:

- Low seepage rates from the WRD;
- Limited hydraulic conductivity of the material underlying the WRD; and
- The retardation effect of the pit dewatering on parts of the modelled contamination plume.

The lined scenario shows a plume that that does not extend as far out from the WRD extension area when compared to the unlined scenario.

Considering that both scenarios result in a plume of low concentration outside of the Mining Right area and that there are no known third parties using boreholes within the predicted plumes, there is no significant difference in the impact severity rating in the unlined and lined scenarios. The severity is rated as low for both the unmitigated and mitigated scenarios.

**Duration**

Groundwater contamination is long-term in nature, occurring for periods longer than the life of mine in both the unmitigated and mitigated scenarios.

**Spatial scale / extent**

The pollution plume will extend beyond the Mining Right area in both the unmitigated and mitigated scenarios.

**Consequence**

The consequence is medium in the unmitigated and mitigated scenarios.

**Probability**

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?

Considering the above, the contamination plume is predicted to reach groundwater resources in the unmitigated and mitigated scenarios. There are however no known third party boreholes located within the simulated contaminant plume in the unmitigated and mitigated scenarios. Based on predicted groundwater modelling, mine related contamination will be at low concentrations outside of the Mining Right area in both the unmitigated and mitigated scenarios. As a combination, the unmitigated and mitigated scenario probability is low.

**Significance**

The unmitigated and mitigated scenario significance is **LOW**.

**UNMITIGATED – SUMMARY OF THE RATED INCREMENTAL CONTAMINATION OF GROUNDWATER IMPACT PER PHASE OF THE PROJECT**

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

**MITIGATED – SUMMARY OF THE RATED INCREMENTAL CONTAMINATION OF GROUNDWATER IMPACT PER PHASE OF THE PROJECT**

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>Operation, decommissioning and closure</b>						
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**

Implement the following management actions during the operation, decommissioning and closure phases:

- The full depth of available soils and subsoils will be placed on to the hard rock spoils, as far as is practical so as to limit ingress.
- The calcrete material will be placed over the hard rock spoils in order to facilitate the development of an aquiclude over the spoils.
- *Immediately notify the DWS should any groundwater resource contamination be detected off-site.*
- *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources indicate that these sources are causing pollution which is migrating off-site.*
- *Prevent pollution through appropriate infrastructure design. In this regard the WRD extension will be constructed according to approved designs.*
- *Re-run the groundwater model periodically during the operational phase as and when additional relevant data becomes available, in order to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, make for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning.*
- *Conduct further source term studies to be used for groundwater modelling updates.*
- *Monitor groundwater quality (refer to Section 28 for the monitoring programme). Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts.*
- *Implement the emergency response procedure in Section 29.2.2 in the event of a potentially polluting discharge incident.*

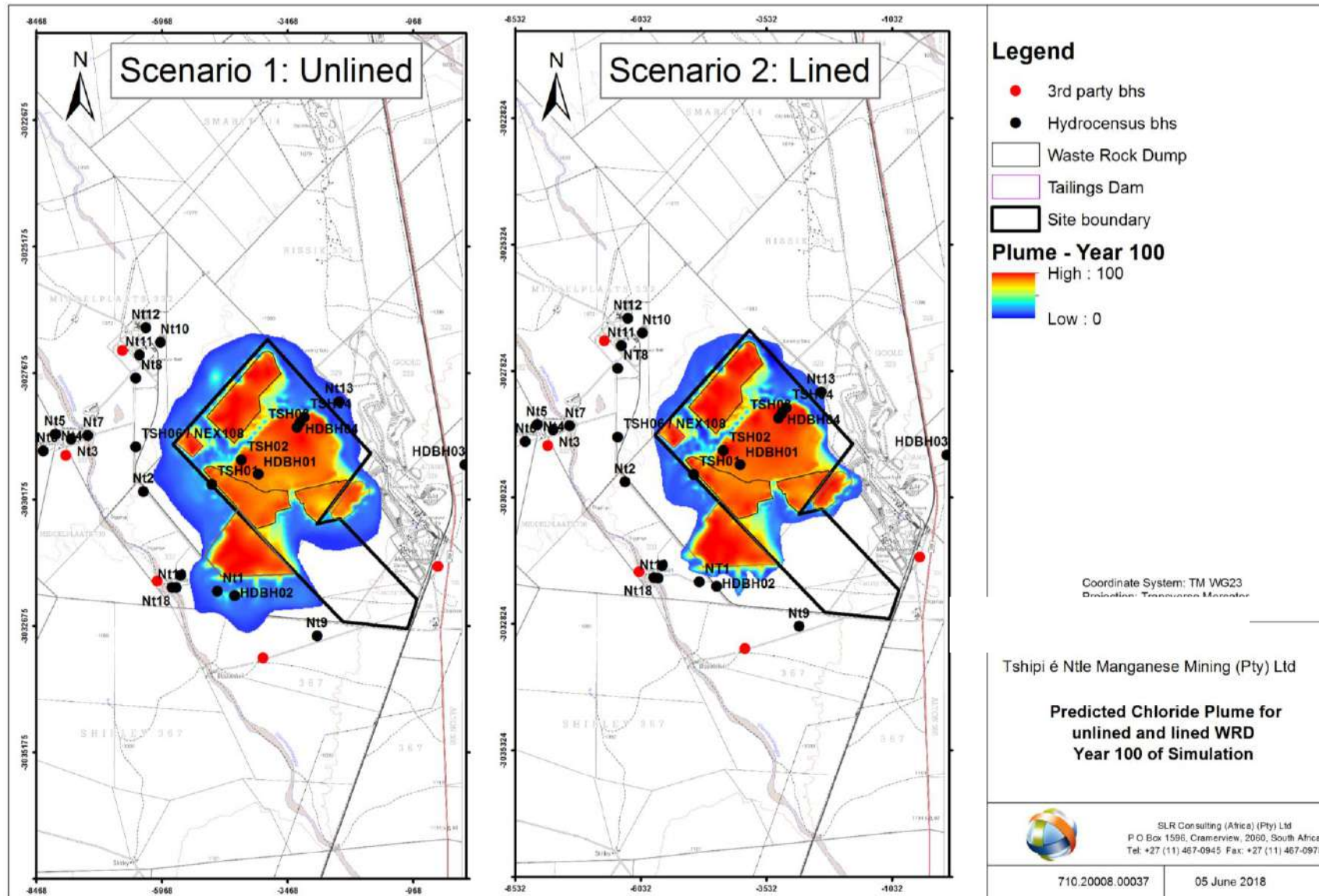


FIGURE 22: PREDICTED CHLORIDE PLUME – YEAR 100 OF SIMULATION (SLR, 2018)

**AIR QUALITY**

**ISSUE: AIR POLLUTION**

Information in this section was sourced from the air quality study completed for the adjacent Tshipi Borwa Mine (Airshed, 2018a).

**INTRODUCTION**

The extension of the WRD presents a number of sources that can have a negative impact on ambient air quality and surrounding land uses in all phases. Sources include clearing of vegetation, materials handling, wind erosion from stockpiles and wind erosion of disturbed areas. These activities already take place on site as the mine is in operation; however, the establishment and operation of the proposed WRD extension would contribute additional dust generation sources.

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
Site preparation Earthworks	Waste rock disposal	Rehabilitation of land forms	Final land forms

**RATING OF IMPACT**

**Severity / nature**

The main contaminants associated with the proposed project includes: inhalable particulate matter less than 10 microns in size (PM<sub>10</sub>) (including a manganese component) and larger total suspended particulates (TSP) that relate to dust fallout. The inhalable components can cause human health impacts at high concentrations over extended periods, while the larger particulate component can cause nuisance dust impacts such as soiling of grazing veld at high fallout quantities over extended periods. 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.

During all project phases dust will be generated by activities associated with the extension of the WRD (see table above). The advantage of the WRD from an air quality perspective is that the footprint is small (approximately 4 ha), and that it is shielded by the existing Tshipi Eastern WRD to the west and the existing Mamatwan WRD to the east. The Tshipi Eastern WRD should act as a wind barrier from the stronger westerly winds, and to some extent from the northerly winds. The filling of waste rock into the void instead of tipping at the crest of the WRD, would also reduce potential impacts. At decommissioning, truck activity, tipping of topsoil and levelling out of the exposed side slopes during rehabilitation might result in significant dust generation.

Taking the above into account, the incremental increase in ground level concentrations for PM<sub>10</sub> or PM<sub>2.5</sub> and dust fallout off-site is rated as having a low severity in both the unmitigated and mitigated scenarios. With mitigation measures in place impacts should be limited, and reduce the severity further.

**Duration**

The duration of potential impacts in both the unmitigated and mitigated scenario is rated as medium term (for the life of the project). Given the low severity of potential impacts associated with the extension of the WRD, long term health related impacts are not expected to occur.

**Spatial scale / extent**

The spatial scale of the potential impact could be beyond the immediate operational area of the mine in the unmitigated scenario. With mitigation this can be localised to within the site boundary.

**Consequence**

The consequence is rated low in both the unmitigated and mitigated scenarios.

**Probability**

The health impact probability is linked to the probability of ambient concentrations exceeding the evaluation criteria at potential third party off-site receptors. Given the discussion above that the WRD extension will be shielded by existing Tshipi and Mamatwan WRDs and the distance of between 3 and 6 km to the nearest potential receptors, the probability of exceedances at off-site receptors is considered to be low in the unmitigated scenario. With mitigation the probability is further reduced.

**Significance**

The significance of the potential incremental impact associated with the extension of the WRD is rated **LOW** in the unmitigated and mitigated scenarios.

**UNMITIGATED – SUMMARY OF THE RATED INCREMENTAL AIR POLLUTION IMPACT PER PHASE OF THE PROJECT**

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>All phases</b>						
Unmitigated	L	M	M	L	L	L

**MITIGATED – SUMMARY OF THE RATED INCREMENTAL AIR POLLUTION IMPACT PER PHASE OF THE PROJECT**

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>All phases</b>						
Unmitigated	L	M	L	L	L	L

**MANAGEMENT OBJECTIVE**

The objective is to prevent air pollution health impacts.

**MANAGEMENT ACTION**

Implement the following management actions during all mine phases:

- *Fill waste rock in the void and avoid tipping waste rock from the crest of the existing WRD.*
- *Once the void is filled, dump waste rock on the WRD in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position.*
- *Use dust allaying measures, such as water sprays or equivalent controls to limit the generation of dust, at waste rock tipping points on the WRDs.*
- *Allow topsoil stockpiles and WRD side slopes to re-vegetate naturally. Should re-vegetation cover be insufficient after a rainy season, implement additional dust management measures, such as the use of geotextiles and wind breaks or other methods that are proven to be effective.*
- *General good housekeeping will be maintained in all areas prone for dust release. Regular inspection and maintenance routines will be implemented in areas to address spillage on ground, thereby preventing the re-suspension of settled dust.*
- *Maintain a complaints register that is available at the mine. The date and time noted on the complaints register will be the date and time that the reported problem is observed, not the date and time that the complaint is logged. Compare the complaints register to air quality monitoring data, as well as recorded meteorological data, to identify problem areas and then iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources;*
- *Continuous implementation of the dust monitoring programme as outlined in Section 28 of the main report. Report dustfall results annually to the District Municipality Air Quality officer.*

**NOISE**

**ISSUES: INCREASE IN DISTURBING NOISE LEVELS**

**MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE**

Construction	Operational	Decommissioning	Closure
			N/A
Site preparation Earthworks	Waste rock disposal	Rehabilitation of land forms	-

**DISCUSSION**

Although the development and disposal of waste rock as part of the proposed project is associated with noise generating activities, the incremental increase in noise levels at potential receptor sites is expected to be negligible. This is based on the results of the background noise sampling completed in December 2018 (which was undertaken at a time when mining operations were active) which indicated that the area has noise levels typical of a rural area as well as the location of the proposed project area centrally between the current Tshipi and MMT mining activities. This is further influenced by the short-term duration of the activities (less than the life of mine)



and the distance of between 3 and 6 km between the WRD extension area and potential noise receptors. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below are required to ensure this rating is achieved.

**MANAGEMENT OBJECTIVE**

To prevent public exposure to disturbing noise.

**MANAGEMENT ACTIONS**

Implement the following management actions during all project phases prior to closure:

- *Maintain all diesel-powered earth moving equipment in order to limit noise, including the checking and replacement of exhaust and intake silencers;*
- *Maintain all haul roads in a good state of repair at all times to avoid unwanted rattle and “body-slap” from vehicles;*
- *Operate equipment 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;*
- *Record and respond immediately to complaints about disturbing noise. Document and recorded such complaints as incidents, and document the measures taken to address these. Keep these records for the life of mine;*
- *Undertake noise monitoring following the receipt of a complaint. Where necessary, implement additional management actions to avoid repeat occurrences.*
- Noise monitoring will be undertaken on an annual basis in accordance with the SABS code 0103 in order to evaluate the impact of the mining. The target will be that adjacent residences should not experience more than a 5dBA increase over the background levels.

**VISUAL**

**ISSUE: NEGATIVE VISUAL VIEWS**

**MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE**

Construction	Operational	Decommissioning	Closure
N/A			
-	Waste rock disposal	Rehabilitation of land forms	Final land forms

**DISCUSSION**

The visual landscape within the MMT area has been transformed due to the presence of approved mining infrastructure and activities. The proposed WRD extension area is located centrally between the current Tshipi Borwa Mine and the MMT mining activities and is therefore not expected to influence existing negative visual impacts. The WRD extension would be absorbed into current views of the mining activities. At closure the WRD extension would be rehabilitated in line with the mine’s rehabilitation and closure plan which makes provision for a final land use of wilderness. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below are required to ensure this rating is achieved.

**MANAGEMENT OBJECTIVE**

The objective is to limit negative visual impacts.

**MANAGEMENT ACTIONS**

Implement the following management actions to be implemented during the operational, decommissioning and closure phases:

- *Clear and expose only the footprint area as defined by the approved layout in this EMPr;*
- *Dust in the mine area to be controlled by means of water spraying.*
- *Effectively rehabilitate the WRDs which is critical because these will be a permanent post closure features. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities;*
- *Ensure that all vegetation that is planted as part of rehabilitation will reflect the natural vegetation of the area, as far as is practicable;*
- *Shape any residual WRDs left on surface; and*
- *Manage final rehabilitated areas and landforms remaining in perpetuity 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**

The proposed WRD extension will not generate additional traffic and as such project-related road disturbance and traffic safety impacts are not expected to occur. This issue is therefore not assessed further in this EIA. The significance of impacts associated with the overall MMT would remain unchanged.

**HERITAGE/CULTURAL AND PALEONTOLOGICAL RESOURCES**

**ISSUE: LOSS OF HERITAGE/CULTURAL AND PALAEOLOGICAL RESOURCES**

Information in this section was sourced from the heritage exemption letter compiled for this EIA (see Appendix F).

**MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE**

Construction	Operational	Decommissioning	Closure
		N/A	N/A
Site preparation Earthworks	Waste rock disposal	-	-

**DISCUSSION**

No heritage resources occur within the area proposed for the WRD extension. In addition, there is a low possibility of palaeontological resources occurring in the area (see Section 7.4.1.12 of the main report). This impact has therefore been rated as being **INSIGNIFICANT**; 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 ACTIONS**

Management actions to be implemented in the construction and operational phases include:

- Consult a professionally registered heritage and/or palaeontological specialist to make associated recommendations that will be complied with prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance at the mine.
- Implement the emergency response procedure (Section 29.2.2) if there are any chance finds of heritage/cultural or paleontological sites.

**SOCIO-ECONOMIC**

**ISSUE: INWARD MIGRATION AND ECONOMIC IMPACT**

Given that the project forms part of existing approved operations and that the proposed extension to the WRD will not generate any additional employment opportunities, negative project-related socio-economic impacts including inward migration are not expected to occur. In addition, the extension of the WRD is required to provide additional capacity to store waste rock that is generated as part of mining the boundary pillar. The economic benefits associated with mining the boundary pillar have previously been accounted for. As a result the potential for increased economic benefits due to project activities is expected to be negligible. This issue is therefore not assessed further in this BAR. The significance of impacts associated with the overall MMT would remain unchanged.

**LAND USE**

**ISSUE: CHANGE IN LAND USES**

Information in this section was sourced from on-site observations and the project team.

**INTRODUCTION**

Mining-related 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 proposed WRD extension will be established within the existing mining area and will not change the current land use. The assessment below therefore focuses on potential impacts on surrounding land uses.

**MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE**

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks	Waste rock disposal	Rehabilitation of land forms	Final land forms

**RATING OF IMPACT**

**Severity / nature**

The proposed WRD extension is located centrally between the Tshipi and MMT mining operations and therefore potential impacts on surrounding land uses are limited to potential groundwater and air quality impacts. In both instances, potential impacts would occur within the boundaries of the MMT mining right or the adjacent Tshipi Borwa mining right area. Potential impacts are not predicted to other extend to third party land uses. The related severity is low in both the unmitigated and mitigated scenarios

**Duration**

In the unmitigated scenario the duration is high because the impacts would continue post closure. In the mitigated scenario the duration will be reduced because the WRD will have been rehabilitated.

**Spatial scale / extent**

In all phases land use impacts are likely to extend beyond the mine in both the unmitigated and mitigated scenarios.

**Consequence**

The unmitigated consequence is medium. With management actions this reduces to low.

**Probability**

In the unmitigated and mitigated scenarios the probability of a change in surrounding land uses due to the proposed extension of the WRD is unlikely. At closure when the mine site has been rehabilitated, the probability is further reduced.

**Significance**

The significance is **LOW** in both the unmitigated and mitigated scenarios.

**UNMITIGATED – SUMMARY OF THE INCREMENTAL LAND USE IMPACT PER PHASE OF THE PROJECT**

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

**MITIGATED – SUMMARY OF THE INCREMENTAL LAND USE IMPACT PER PHASE OF THE PROJECT**

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

## MANAGEMENT OBJECTIVE

The objective of is to prevent unacceptable negative impacts on surrounding land uses.

## MANAGEMENT ACTIONS

The following management actions will be implemented in all phases:

- *Implement the mitigation measures as outlined in the EMPr;*
- *Communicate with neighbouring land owners and users as required to facilitate information sharing and management of environmental impacts associated with the WRD extension; and*
- Rehabilitate the overall site to provide for the post closure land use in accordance with the mine Closure Plan.

## **APPENDIX F: HERITAGE/PALAEONTOLOGICAL EXEMPTION LETTER (PGS, 2019)**

## APPENDIX G: COMPOSITE MAP

Figure 23: Composite map

## APPENDIX H: SOUTH32 CRISIS AND EMERGENCY MANAGEMENT PROCEDURES



## APPENDIX I: FINANCIAL PROVISION

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