



FINANCIAL PROVISION FOR THE MERCING OF THE MAMATWAN SINTERFONTEIN AND TSHIPI EASTERN WASTE ROCK DUMPS

Mamatwam Mine

Prepared for: Mamatwan Mining

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EXECUTIVE SUMMARY

INTRODUCTION

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:

- 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. 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 (South Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by Hotazel Manganese Mines (Pty) Ltd to prepare the preliminary closure plan financial provision for proposed project (WRD extension).

PRELIMINARY CLOSURE PLAN OBJECTIVES

The preliminary closure plan objectives and principles for the proposed project 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;
- 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; and
- Shape the merged WRD to create a stable landform.

LEGAL FRAMEWORK

A preliminary financial provision has been prepared for the project. This financial provision 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). The table below details the requirements of GNR 1147 and also the relevant sections in the report where these requirements are addressed.

It is important to note that this is a preliminary financial provision report. The closure cost liability 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.

GNR 1147 – Appendix 3, 4 and 5		Relevant section in the report
Annual Rehabilitation Report (Appendix 3)		
3(a)-(g)	Content of report	Section 2
Closure Plan (Appendix 4)		
3(a)	Details of the specialists	Section 2
3(b)(i)	Material information	Section 3.1
3(b)(ii)	Environmental and social context	Section 3.2
3(b)(iii)	Stakeholder issues and comments	Section 3.3
3(b)(iv)	Mining plan and schedule	Section 4
3(c)(i)	Risk assessment methodology	Section 5.1
3(c)(ii)	Identification of indicators	Section 5.3
3(c)(iii)	Strategies to manage/mitigate risks	Section 5.2
3(c)(iv)	Reassessment of risks	Section 5.4
3(c)(v)	Changes to risk assessment results	n/a – no changes deemed necessary
3(d)(i)	Legal and governance framework	Section 6.1
3(d)(ii)	Closure vision and objectives	Section 6.2
3(d)(iii)	Evaluation of alternatives	Section 6.3
3(d)(iv)	Motivation for closure option	Section 6.4
3(d)(v)	Motivation for closure period	Section 6.5
3(d)(vi)	Details of ongoing research	Section 6.6
3(d)(vii)	Assumptions made for closure	Section 6.7
3(e)(i)	Post-mining land use	Section 7
3(e)(ii)	Map of post mining land use	n/a – land to be returned to pre-disturbance state
3(f)(i)	Specific technical solutions	Section 8
3(f)(ii)	Threats and uncertainties	Section 8
3(g)(i)&(iii)	Schedule of actions	Section 9

GNR 1147 – Appendix 3, 4 and 5		Relevant section in the report
3(g)(ii)	Assumptions and drivers	Sections 6.7
3(h)(i)-(iii)	Organisational capacity and structure	Section 10
3(i)	Indication of gaps	Section 11
3(j)	Relinquishment criteria	Section 12
3(k)(i)	Closure cost estimate & accuracy	Section 13
3(k)(ii)	Closure cost estimate methodology	Section 13.2
3(k)(iii)	Annual updates	Section 13.3
3(l)(i)-(iii)	Monitoring, auditing and reporting	Section 15
3(m)	Amendments to the closure plan	n/a – no amendments deemed necessary
Environmental Risk Assessment (Appendix 5)		
(a)	Details of the specialists	Section 2
(b)(i)	Risk assessment methodology	Section 5.1
(b)(ii)	Latent risk substantiation	Section 5.5
(b)(iii)	Risk drivers	Section 5.3
(b)(iv)	Expected timeframe	n/a – no latent risks identified
(b)(v)	Risk triggers	n/a – no latent risks identified
(b)(vi)	Risk assessment results	Section 5.2
(b)(vii)	Changes to risk assessment results	Section 5.4
(c)(i)	Monitoring to inform management	Section 15
(c)(ii)-(iv)	Alternative mitigation measures following impacts	n/a – no changes to risk identified
(d)(i)-(iii)	Cost estimation and accuracy	Section 13
(e)	Monitoring, auditing and reporting	Section 15

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.

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1. INTRODUCTION

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:

- 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.
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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. 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, an independent firm of environmental consultants, has been appointed by Hotazel Manganese Mines (Pty) Ltd to prepare the financial provision for proposed project.

2. SPECIALIST INPUT

2.1 SPECIALISTS THAT PREPARED THE FINANCIAL PROVISION

The details of the persons who prepared this financial provision report are provided in Table 2-1 below.

Table 2-1: Details of the persons who prepared this report

Details	Environmental Assessment Practitioner and author	Professional Engineer and reviewer	Environmental Assessment Practitioner and author
Company:	SLR	SLR	SLR
Name:	Natasha Smyth	Steve van Niekerk	Alex Pheiffer

Details	Environmental Assessment Practitioner and author	Professional Engineer and reviewer	Environmental Assessment Practitioner and author
Tel No.:	011 467 0945	011 467 0945	011 467 0945
Fax No.:	011 467 0978	011 467 0978	011 467 0978
E-mail:	nsmyth@slrconsulting.com	svanniekerk@slrconsulting.com	apheiffer@slrconsulting.com

2.2 EXPERTISE OF THE SPECIALISTS

Alex Pheiffer holds an MSc in Environmental Management, is registered as a Professional Natural Scientist (Environmental Science) (#400183/05) with the South African Council for Natural Scientific Professions and has approximately 15 years of relevant experience.

Natasha Smyth holds a Hons in Geography and Environmental Management and has over 10 years of relevant experience.

Stephen van Niekerk is a manager at SLR, holds a MSc Engineering degree, has over 20 years of relevant experience and is registered as a Professional Engineer (#20010256) with the Engineering Council of South Africa (ECSA).

Copies of the specialist’s curriculum vitae are attached in Appendix A.

2.3 DECLARATION OF INDEPENDENCE

I, Natasha Smyth and Steve van Niekerk hereby declare that we are independent consultants, who have no interest or personal gains in this proposed project whatsoever, except receiving fair payment for rendering an independent professional service.

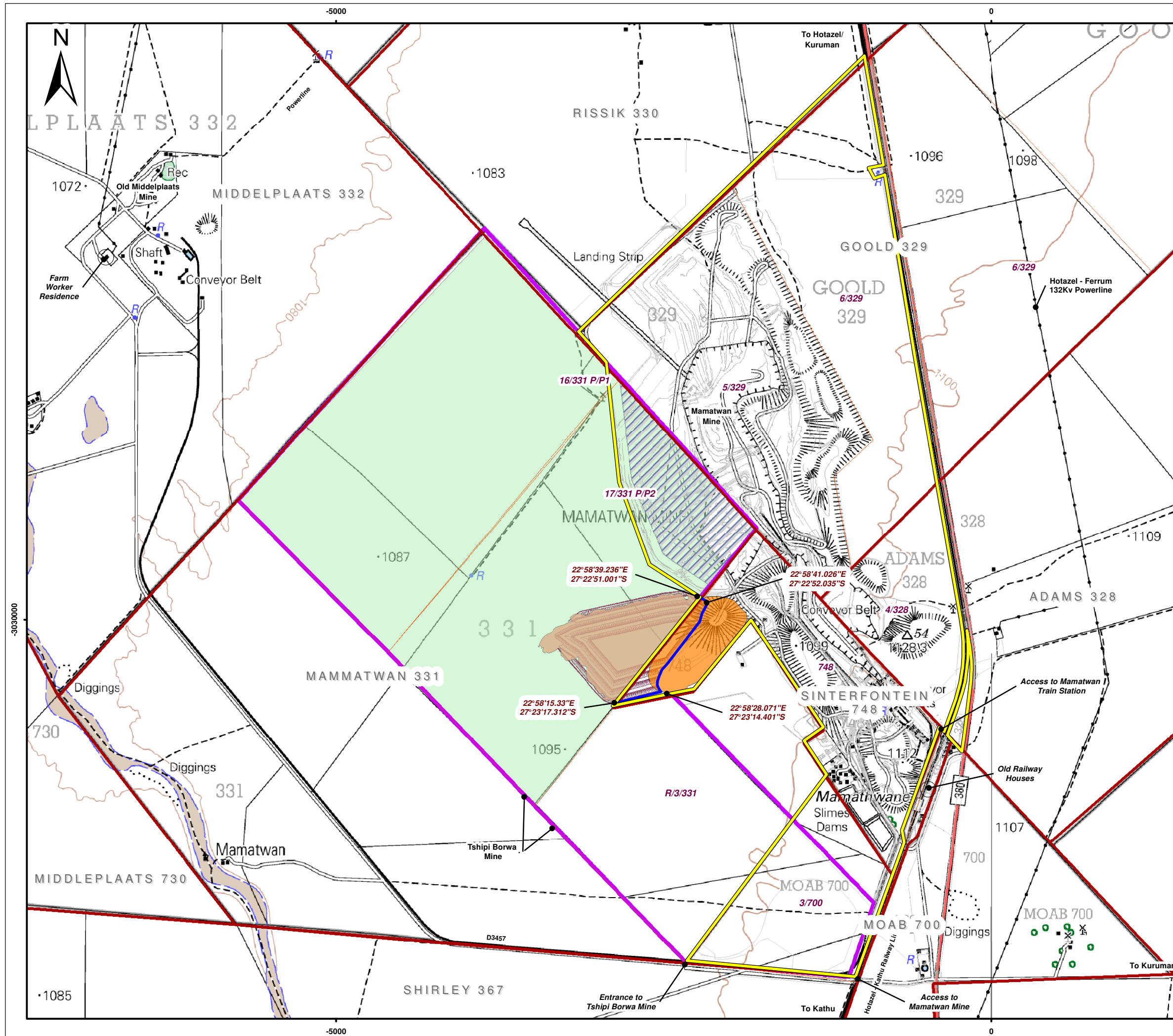
3. CONTEXT OF THE PROJECT

3.1 MATERIAL INFORMATION

This financial provision 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).

South32 operates the open pit manganese (MMT) located on portion 5 and 6 of the farm Goold 329, the farm Sinterfontein 748, portion of portion 2 (Currently Portion 17) and portion of portion 1 (Currently Portion 16) of the farm Mamatwan 331, portion 3 of the farm Moab 700 and portion 4 of the farm Adams 328.

An 18m wide (on surface) boundary is located between the MMT and the Tshipi Borwa Mine (Figure 1). 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.



- 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

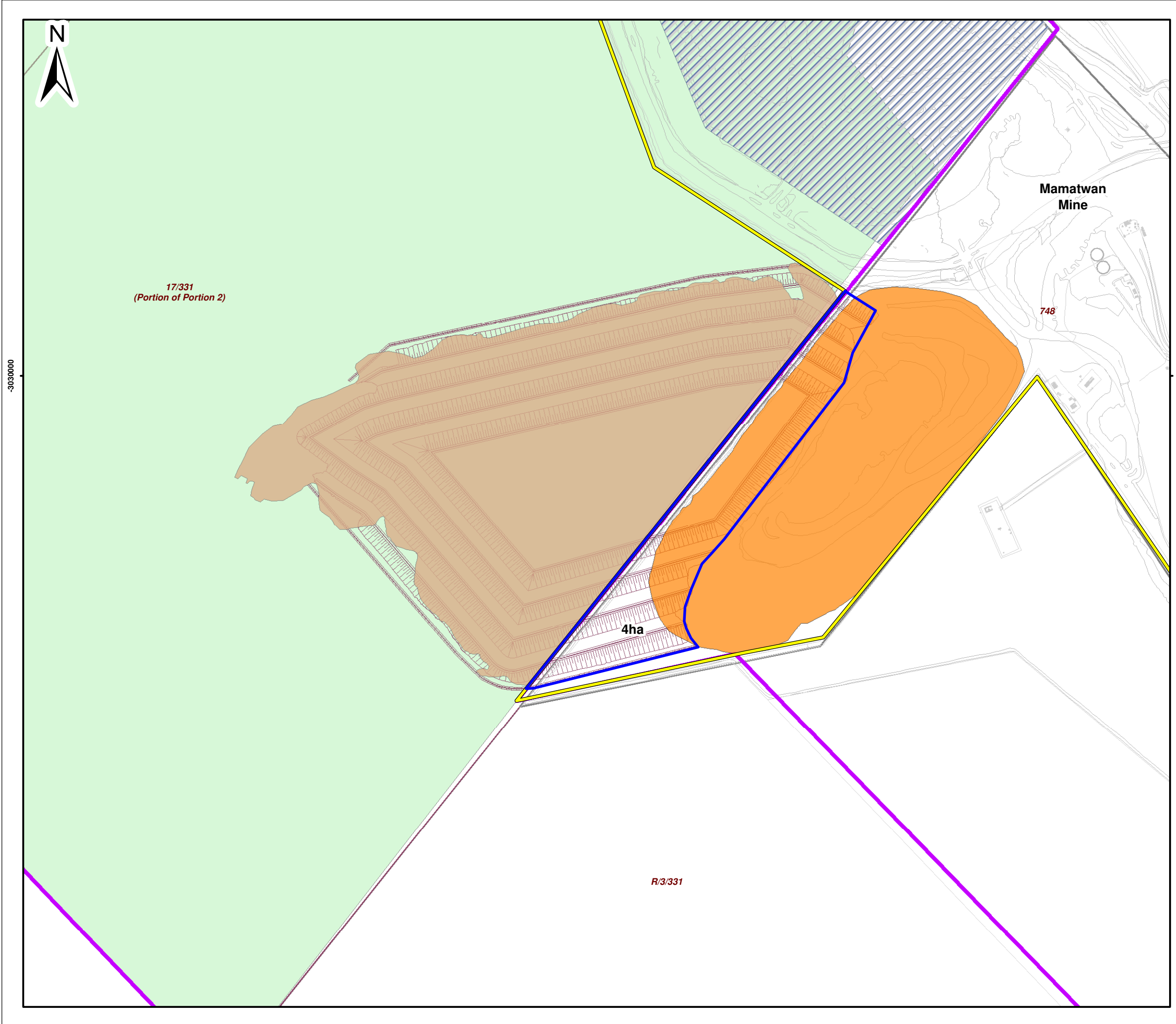
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 Datum: WGS1984, Lo23

Mamatwan Mine

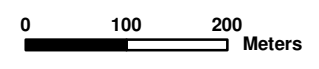
Figure 1
Local Setting

SLR

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- 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 2
Conceptual Site Layout Illustrating the WRD Merge



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3.2 ENVIRONMENTAL AND SOCIO-ECONOMIC OVERVIEW

The information in this section provides a summary of the environmental and socio-economic baseline situation that is likely to be influenced by the proposed project. Information in this section was sourced from the Basic Assessment Report (BAR) compiled for the proposed project (SLR, April 2019). For further information, refer to Section 7.4 of the BAR (SLR, September 2017).

Table 3-1: Overview of environmental and socio-economic baseline situation

Aspect	Overview
Topography	<p>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 3km west and the Witleegte River is located approximately 6km northeast of the proposed project site (Figure 1). The natural topography of the area surrounding the MMT has been influenced largely through mining activities such as the Tshipi Borwa Mine, the old Middelplaats Mine, the United Manganese of Kalahari Mine and the Adams Solar Farm.</p> <p>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.</p>
Climate	<p>MMT falls within the Northern Steppe Climatic Zone. It is a semi-arid region characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter. The area is associated with an annual rainfall of 372mm. Winds from the north, north-east are dominant in the area.</p>
Soils and land capability	<p>The soil forms identified within the study area is Witbank. 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. Soils in the project area have limited agricultural potential.</p>
Biodiversity	<p>All natural vegetation within the study area is seen as <i>Acacia</i> Thornveld and is considered an open savanna. The extension of the WRD would take place within the Disturbed <i>Acacia Thornveld</i> and more specifically the Dense <i>Acacia mellifera</i> Thornveld. The Dense <i>Acacia mellifera</i> Thornveld is a sparse grass layer, with the shrub layer dominated by <i>Acacia (Senegalia) mellifera</i>. 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 <i>A mellifera</i> and <i>Grewia</i> shrubs. Studies have shown that the accumulation of excessive Mn in leaves causes a reduction of photosynthetic rate. No floral species of concern are located within the proposed project area. No flora species of concern have been recorded on site.</p> <p>Alien species are present at the mine but mainly within disturbed areas where soils have been exposed or where mining related activities occur.</p> <p>The proposed footprint is located within an area rated to have a moderate-low sensitivity.</p>
Surface water	<p>The project area is located within the Lower Vaal Water Management Area. The project area falls within the quaternary catchment D41K which has a gross total catchment area of</p>

Aspect	Overview
	4 216 km ² , with a net mean annual runoff (MAR) of 6.53 million cubic meters (mcm). 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). There is no third party reliance on surface water. No wetlands are located in the proposed project area.
Groundwater	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. 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. The majority of the groundwater is used to supply drinking water for cattle and in some instances supply water for domestic use. Groundwater qualities have been influenced locally by existing mining activities.
Air quality	Ambient air quality has been influenced by mines, household fuel combustion, vehicle tailpipe emissions and agricultural activities. Monitoring results indicate that dust fallout limits are within limits set out in the National Dust Control Regulations (NDCR). Potential receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 3 and 6 km from the mine. These are owned and/or occupied by farmers and farm workers.
Visual aspects	The visual value within the project area is low due to the MMT's current approved mining infrastructure and activities. The visual value surrounding the project area is medium to low due to the combination of existing infrastructure (mining operations, road infrastructure, powerline infrastructure, solar farm and isolated residences and farmhouses) and the presence of undisturbed areas that provide open views of the natural bushveld and the Vlermuisleegte River.
Socio-economic	There are communities, mines, private landowners and farm occupants surrounding the MMT. Unemployment and education levels in the area are higher than the provincial and municipal average. Basic services infrastructure appears to be far less formalized when considering the province and municipalities as a whole.
Land use	Land use within the project area is limited to mining activities associated with the MMT. Land uses surrounding the proposed project area include agriculture (ad-hoc livestock grazing), isolated farmsteads, small towns (eg. Hotazel), dormant and active mines, roads, powerlines, a solar farm, a railway line and the Vaal Gamagara pipeline.

3.3 STAKEHOLDER ISSUES AND COMMENTS

As part of the Basic Assessment process a public participation process was undertaken for the proposed project. To date, no issues and concerns around rehabilitation and closure objectives has been raised. This Financial Provision report has been prepared in support of the Basic Assessment process for the proposed project. The BAR together with this report will be made available for public review. This report will be updated to include any closure comments and concerns raised during the public review period.

4. MINE PLAN AND SCHEDULE

Information in this section was sourced from the BAR (SLR, April 2019) for the proposed project. A summary of the key project components is provided in the section below. For further detail refer to Section 3 of the BAR for the proposed project.

4.1 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 3 below. A site layout plan showing the conceptual layout of the WRD merge is illustrated in Figure 2.



Figure 3: Photographs depicting the proposed extended WRD footprint area

4.1.1 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.

4.1.2 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 4-1.

Table 4-1: 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 m ³ 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,	Waste rock will be loaded into mining dump trucks and hauled to the Sinterfontein

Feature		Detail
placement		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.
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 trials. 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 trials.</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 4-2 below.

Table 4-2: 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)		
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)		

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.

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.

4.1.3 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.

4.1.4 Life of project

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

4.1.5 Areas of disturbance

The merging of the waste rock dump void within the MMT Mining Rights area will disturb an area of approximately 4ha.

5. ENVIRONMENTAL RISK ASSESSMENT

5.1 RISK ASSESSMENT METHODOLOGY

The methodology applied to assess the significance of risks is provided in the table below.

Table 5-1: 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*					
Definition of SIGNIFICANCE		Significance = consequence x probability			
Definition of CONSEQUENCE		Consequence is a function of severity, spatial extent and duration			
Criteria for ranking of the SEVERITY of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.			
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.			
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.			
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.			
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.			
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.			
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term			
	M	Reversible over time. Life of the project. Medium term			
	H	Permanent. Beyond closure. Long term.			
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.			
	M	Fairly widespread – Beyond the site boundary. Local			
	H	Widespread – Far beyond site boundary. Regional/ national			
PART B: DETERMINING CONSEQUENCE					
SEVERITY = L					
DURATION	Long term	H	Medium	Medium	Medium
	Medium term	M	Low	Low	Medium
	Short term	L	Low	Low	Medium
SEVERITY = M					
DURATION	Long term	H	Medium	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Low	Medium	Medium
SEVERITY = H					
DURATION	Long term	H	High	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Medium	Medium	High
			L	M	H
			Localised Within site boundary	Fairly widespread Beyond site boundary	Widespread Far beyond site boundary Regional/ national

			Site	Local	
SPATIAL SCALE					
PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	H	Medium	Medium	High
	Possible/ frequent	M	Medium	Medium	High
	Unlikely/ seldom	L	Low	Low	Medium
			L	M	H
CONSEQUENCE					

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

5.2 IDENTIFICATION OF STRATEGIES TO MANAGE AND MITIGATE THE IMPACTS AND RISKS

Impacts and risks identified for the proposed project that are likely to extend post-closure are included in Table 5-2 below. Strategies to manage and mitigate impacts and risks (Table 5-3) have been identified, taking into account, the findings of specialist studies (where relevant), input from stakeholders and consideration of the project plan. These management and mitigation strategies are aimed at controlling the project activities and process which have the potential to result in environmental degradation.

Table 5-2: Impacts and risks identified for the proposed project

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
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. This impact has therefore been rated as being insignificant.	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. This impact has therefore been rated as being insignificant.	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 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	Medium	Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		biodiversity specialist to have moderate-low sensitivity. This is a medium significance in the unmitigated scenario and a low significance in the mitigated scenario.		
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. This impact has therefore been rated as being insignificant.	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 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.	Insignificant	Insignificant
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. This is a low significance in the unmitigated and mitigated scenarios.	Low	Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
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. This is low significance in the unmitigated and mitigated scenarios.	Low	Low
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 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 grazing. This impact has therefore been rated as being insignificant.	Insignificant	Insignificant
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. This is a low significance in the unmitigated and mitigated scenarios.	Low	Low

Table 5-3: Strategies to manage and mitigate impacts and risks

Aspect	Potential Impact	Management actions
Topography	Altering topography	Implement the following management actions during all mine phases: <ul style="list-style-type: none"> 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.
Soils and land capability	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"> Limit land disturbance to those activities and areas that are described in the EMPr; Implement the soil conservation procedure; 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: <ul style="list-style-type: none"> 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; 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 the event any major spillage incident.
Biodiversity	Physical destruction of biodiversity an general disturbance	Implement the following management actions during all mine phases: <ul style="list-style-type: none"> 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; 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;

Aspect	Potential Impact	Management actions
		<ul style="list-style-type: none"> • 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 the event of a potentially contaminating incident.
Surface water	Alteration of natural drainage patterns	<p>Implement the following management actions during all mine phases:</p> <ul style="list-style-type: none"> • 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"> ○ 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.

Aspect	Potential Impact	Management actions
Surface water	Contamination of surface water resources	<p>Implement the following management actions during all mine phases:</p> <ul style="list-style-type: none"> 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 the event of a potentially polluting discharge incident.
Groundwater	Contamination of groundwater resources	<p>Implement the following management actions the operational, decommissioning and closure phases:</p> <ul style="list-style-type: none"> 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. Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts; and Implement the emergency response procedure in the event of a potentially polluting discharge incident.
Air	Air pollution	<p>Implement the following management actions during all mine phases:</p> <ul style="list-style-type: none"> 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

Aspect	Potential Impact	Management actions
		be effective. <ul style="list-style-type: none"> • 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. Report dustfall results annually to the District Municipality Air Quality officer.
Land use	Change in land use	The following management actions will be implemented in all phases: <ul style="list-style-type: none"> • 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.

5.3 IDENTIFICATION OF INDICATORS

Two key indicators have been defined which will facilitate evaluation of the ongoing environmental impacts and associated risk to closure (risk triggers). These two key indicators can be evaluated through analysis of ongoing monitoring results. The two key indicators are namely:

- Groundwater quality.
- Vegetative cover.

Surface water quality has not been selected as a key indicator given the lack of surface water anticipated post closure. The closest watercourses are located approximately 3km (Vlermuisleegte) and 6km (Witleegte) from the MMT are ephemeral in nature and highly seasonal.

The first indicator, groundwater quality, is an important measure of the effectiveness of mitigation activities (for final land forms) and for protecting the health and safety of neighbouring and/or down gradient land users, livestock, and wildlife.

The second indicator, vegetative cover, is highly correlated with all the other major environmental parameters of the area, including erosion, dust, physical stability, chemical stability, soil quality and hydrology. Good vegetative cover results in a reduction in the volume of surface runoff, increases soil and slope stability, and leads to the formation of an organic layer. In addition, vegetative growth is visually correlated with successful rehabilitation (and/or protection of the surrounding environment). This is an extremely important indicator because it provides a simple, very effective and relevant measure of the lands' current (and/or future) capability.

5.4 REASSESSMENT OF RISKS

An environmental monitoring programme has been established at the MMT to provide early warning systems necessary to avoid environmental emergencies, and for informing continual improvement of the mine closure plan. The monitoring programme includes:

- Surface water resource quality.
- Groundwater resource quality.
- Air quality.
- Disturbance of biodiversity.

Impacts requiring monitoring (including responsibility and frequencies) are detailed in Section 28 of the BAR for the proposed project for further information (SLR, April 2019).

The environmental manager will conduct internal management audits against the commitments in the EMP reports in accordance with an annual audit plan. The audit findings will be documented for both record keeping purposes and for informing continual improvement of the mine closure plan. In addition, an independent qualified professional conducts an EMP performance assessment in accordance with the relevant NEMA Regulations (GNR 982, 2014).

5.5 FINANCIAL PROVISION FOR LATENT ENVIRONMENTAL IMPACTS

The costs associated with the post closure management and monitoring of environmental impacts has been estimated and included in the overall closure cost liability calculations (see Section 13). Groundwater quality is

not expected to change as a result of the merging of the waste rock dumps. No specific residual or latent environmental impacts have been costed at this stage. Additional remediation activities (i.e. remediation activities not currently anticipated, and if required) will be identified during the on-going operation of the mine through the various monitoring programmes, environmental audits and/or updated risk assessment and pollution potential studies.

6. CLOSURE AND DESIGN PRINCIPLES

6.1 LEGAL AND GOVERNANCE FRAMEWORK

This report has been drafted in accordance with the Financial Provisioning Regulations, 2015 (GNR 1147 of 20 November 2015), for inclusion into the BAR for the proposed project. However, as the DMR guidelines are still used to calculate cost estimates, 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.

It is a requirement of the Environmental Impact Assessment Regulations, 2014 (GNR 982 of 4 December 2014) (as amended) that a closure plan must contain the information set out in Appendix 4 of these Regulations (GNR 982), and, where the application for an environmental authorisation is for prospecting, mining, exploration, extraction and primary processing of a mineral or petroleum resource or activities directly related thereto, the closure plan must address the requirements as set in the Financial Provisioning Regulations, 2015 (GNR 1147).

It is a requirement of the Mineral and Petroleum Resources Development Amendment Bill, 2013 (Bill 15 of 2013) that the holder of a mining right must make the prescribed financial provision for the rehabilitation and management of any negative environmental impacts due to mining activities.

6.2 VISION, OBJECTIVES AND TARGETS FOR CLOSURE

The vision, objectives and targets for closure have been developed against local environmental and socio-economic context of the proposed project, as well as, regulatory requirements and stakeholder issues and concerns.

Stakeholders will continuously be involved in the closure planning process throughout the mine life. This project forms part of the overall closure for the MMT. The MMT will strive to maintain a good working relationship with stakeholders and the local communities in which they operate. Agreements and final approval will be sought from authorities as closure approaches.

6.2.1 Vision for closure

The overall vision for closure for the MMT mine is to minimise the impacts associated with the closure and decommissioning of the mine and to restore the land to a functioning post-mining land use of wilderness.

6.2.2 Objectives for closure

The preliminary closure plan objectives and principles have been developed for the proposed project against the background of the mine location in the Kuruman region of the Northern Cape, 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;
- 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; and
- Shape the merged WRD to create a stable landform.

Additional and more specific closure objectives may be tied to the final land use for the entire MMT mining right area, and these will be determined in collaboration with local communities and other stakeholders during the ongoing operations of the MMT.

6.2.3 Targets for closure

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

- Achieve chemical, physical and biological stability for an indefinite, extended time period over disturbed landscapes;
- Protect surrounding surface water, groundwater, soils and other natural resources from loss of utility value or environmental functioning;
- Limit the rate of emissions to the atmosphere of particulate matter and salts to the extent that degradation of the surrounding areas' land capability or environmental functioning does not occur.
- Maximise visual 'harmony' with the surrounding landscape; and
- 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.

6.3 ALTERNATIVE CLOSURE OPTION

No alternative closure and post closure options have been considered at this stage. Any alternative and practical closure and post closure options will be investigated during the on-going operations of the proposed mine.

6.4 MOTIVATION FOR PREFERRED CLOSURE OPTION

The approved EMP (JAWS, 2005), indicates that the MMT site had a land use of grazing prior to the mining operations. The approved EMP (JAWS, 2005), specifies that during the initial post mining period the land use will be wilderness, until such time as grazing as the long term sustainable/land use. Taking this into account, and given the short duration of the proposed project (2 years) and that MMT has a remaining life of 17 years, the preferred closure option for the merged WRD is wilderness.

6.5 MOTIVATION FOR CLOSURE AND POST CLOSURE PERIOD

A 2 to 3 year period for maintenance and aftercare is considered reasonable for the merged WRD given that this is time required for revegetation to re-establish (provided there is sufficient rainfall).

6.6 ON-GOING RESEARCH FOR PROPOSED CLOSURE OPTIONS

Further research regarding the proposed and/or alternative closure options will be ongoing during the remaining life of mine. In this regard, monitoring of trial revegetation programmes to evaluate the

effectiveness and sustainability of revegetation efforts; methods to further improve and/or optimise; as well as inform the post closure maintenance and aftercare period.

6.7 CLOSURE PLAN ASSUMPTIONS

The following assumptions are made for the development of the preliminary closure plan at this stage of the proposed project:

- MMT will follow and adhere to the commitments made in the BAR;
- MMT will follow the mine layout to minimise the potential for additional disturbed areas;
- Runoff water quality from rehabilitated areas will be acceptable and will not require any further treatment;
- No consideration of the social closure costs has been included in this report;
- No assessment of any socio-economic/shared value/ community based programmes being implemented and whether these would continue post-closure of the operation;
- All costs associated with pre-closure monitoring, auditing and reporting are presumed to be covered under the operations expenditure of the mine, and have not been included in this preliminary closure plan; and
- This preliminary closure plan focusses on the objectives for closure for the proposed project only (WRD extension). The MMT has a separate preliminary closure plan that caters for the overall MMT mine operations.

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

7. POST CLOSURE LAND USE

With reference to Section 6.3, post closure land use for the merged WRD is wilderness.

8. CLOSURE ACTIONS

The preliminary closure actions are currently as follows:

- Shape and rehabilitate the merged WRD to create a stable landform.
- Generally accepted closure methods have been used as the basis for determining the closure cost liability.

Further detail is provided below.

8.1 WASTE ROCK DUMP

The merged Mamatwan Sinterfontein and Tshipi Eastern WRD will remain in perpetuity. This WRD will be made safe by pushing down steep slopes (to an angle that will ensure that erosion is limited) shaping to ensure the surface is free draining, and then cover the WRD with 300 mm topsoil/growth medium material (i.e. whatever was initially stripped from the area prior to construction) and revegetated.

8.2 REVEGETATION

Revegetation of disturbed areas will be undertaken by replacing the previously stockpiled topsoil and growth medium materials (typically a 300mm layer) and planting with indigenous grasses (i.e. dry seeding) and deep rooted species such as trees/shrubs (i.e. hand planting of seedlings).

Grass and tree species to be used for revegetation will need to be carefully selected based upon their soil building capabilities, erosion protection characteristics, natural occurrence in the area, social/commercial value, and wildlife habitat value. It is recommended that field trials be undertaken during the mining operations to best determine the plant species and methodology for re-establishing vegetation. Revegetation activities also need to be carefully undertaken so as not to unnecessarily introduce any alien and/or invasive plant species into the area.

It is recommended that seed and plant harvesting be undertaken using vegetation from the surrounding area. Seed collection should be done preferably from April to May. Grass seeds in particular should be harvested as well as pods (from deeper rooted species). A suitable seed store should be established on site. Also, an on-site nursery to germinate tree and shrub species should also be established to provide sufficient stock for revegetation.

Field trials should be undertaken to determine the most successful methods of revegetation that will include the evaluation of: using plugs (seedlings), local seed harvesting, commercially available seed mixes, planting aids (e.g. hydrogel, fertilizer), wet (hydroseeding) or dry seeding techniques, water requirements, maintenance and aftercare requirements, and the time taken to meet the criteria for revegetation success.

Key revegetation challenges include:

- Reducing sand movement (burial) and erosion to allow seedling establishment to take place.
- Low soil nutrient content (that can be further aggravated by incorrect storage).
- Low (and unpredictable/erratic) rainfall in an arid environment i.e. all planting activities should be undertaken at the end of the dry season, although there may still be insufficient summer rainfall to ensure sufficient growth.
- Establishing key stone (deep rooted) species that assist to promote biodiversity (i.e. shallow rooted species) through hydraulic lift and soil stabilisation.

8.3 GROUNDWATER MANAGEMENT

No groundwater management is currently anticipated. This will however be investigated and confirmed in subsequent closure plan updates and through ongoing groundwater monitoring for the MMT. The following recommendations should be addressed as part of this work, namely:

- An audit on the monitoring network be undertaken to identify where improvements to infrastructure is required to prevent possible anthropogenic contamination and to aid the integrity of the water quality monitoring exercise.
- The cumulative impact on groundwater levels due to other surrounding mining operations such as at United Manganese of the Kalahari, Middelpaats and Tshipi Borwa Mine should be determined to understand the regional effect on groundwater levels.

8.4 MAINTENANCE AND AFTERCARE

The rehabilitated WRD will require some form of aftercare and maintenance to ensure closure success. Activities will typically include erosion control and filling of erosion gully's on slopes; fertilising of struggling

rehabilitated areas; monitoring of groundwater quality; monitoring of vegetation composition and diversity; control and eradication of alien plants; monitoring slope stability of waste rock dumps, monitoring of dust fallout, creating firebreaks etc.

9. SCHEDULE OF CLOSURE ACTIONS

A 2 to 3 year aftercare and maintenance period has been provided for. Refer to Section 15.2 for further detail.

10. ORGANISATIONAL CAPACITY

The key personnel who ensure compliance with the EMP commitments are the project's environmental specialists and superintendent. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities include:

- Minimise the areas of possible disturbance by mining activities;
- Inform and commit to follow the annual rehabilitation plan;
- Ensure that the monitoring programmes, audits, and plan updates/reviews are scoped and included in the annual mine budget;
- Identify and appoint appropriately qualified specialists/engineers to undertake the monitoring, auditing and planning work;
- To integrate closure planning into the overall mine operations and mine planning work;
- Appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards;
- Liaise with the relevant structures in terms of the commitments in the Closure Plan;
- Ensure that commitments in the Closure Plan are undertaken and implemented;
- Establish and maintain good working relations with surrounding communities and landowners; and
- Facilitate stakeholder communication, information sharing and grievance mechanism.

11. GAP IDENTIFICATION

Current gaps (and/or known unknowns) associated with the closure plan, that will be addressed during the on-going operations of the mine and will be part of the overall MMT closure plan include:

- Identify what species of grasses, shrubs and trees will best support the post closure land use of wilderness and/or grazing on the various rehabilitated sites;
- Assess the likelihood and/or presence of any Category 1 alien invasive plant species on site;
- Investigate what work activities of the closure plan can be undertaken during operations as part of the annual rehabilitation planning;
- Establish a closure plan committee that will meet on a regular basis to inform the closure planning process;
- Undertake a detailed environmental and closure risk assessment to fully evaluate the potential environmental and closure risks and possible mitigation/control strategies; and
- Initiate trials of seed collection and germination (i.e. on site nursery) to inform: (i) the revegetation plan (i.e. suitable plant species and methodology for re-establishing vegetation) and (ii) to provide sufficient plant stock for revegetation purposes.

12. RELINQUISHMENT CRITERIA

Relinquishment criteria will be developed in communication with the regulatory authorities and project stakeholders to define specific end-points that demonstrate the closure objectives have been met. Two key indicators have been defined which will facilitate evaluation of closure objectives for the merged WRD having been met at the MMT. These two key indicators can be evaluated through analysis of ongoing monitoring results. The two key indicators are namely:

- Groundwater quality, and
- Vegetative cover.

Surface water quality has not been selected as a key indicator given the lack of surface water anticipated post closure. The closest watercourses are located approximately 3km (Vlermuisleegte) and 6km (Witleegte) from the MMT are ephemeral in nature and highly seasonal.

The first indicator, groundwater quality, is an important measure of the effectiveness of mitigation activities (particularly for the latent environmental impact of groundwater associated with the open pit and remaining waste rock facilities) and for protecting the health and safety of post closure land users, neighbouring and/or down gradient land users, livestock, and wildlife.

The second indicator, vegetative cover, is highly correlated with all the other major environmental parameters of the area, including erosion, dust/air quality, physical stability, chemical stability, soil quality and hydrology. Good vegetative cover results in a reduction in the volume of surface runoff, increases soil and slope stability, and leads to the formation of an organic layer. In addition, vegetative growth is visually correlated with successful rehabilitation (and/or protection of the surrounding environment). This is an extremely important indicator because it provides a simple, very effective and relevant measure of the lands' current (and/or future) capability.

13. CLOSURE COST ESTIMATION

13.1 CLOSURE COST ASSUMPTIONS

The closure plan and cost estimate assumptions are outlined in Section 6.7.

13.2 CLOSURE COST METHODOLOGY

13.2.1 Quantities

The quantities are calculated from the site layout plan (Figure 2) and project plan.

13.2.2 Unit rates

The unit (Master) rates for each closure component is taken from the DMR guideline (and inflated by the Consumer Price Index (CPI) to account for escalation since January 2005) and a Multiplication Factor applied depending on the Risk Ranking (low risk) and the Environmental Sensitivity. The average annual percentages in the CPI as provided by Statistics South Africa are provided in Table 13-1 below.

Table 13-1: Average annual percentage change in CPI

January to December

January to December							
2005	2006	2007	2008	2009	2010	2011	2012
3.4 %	4.6 %	7.2 %	11.5 %	7.1 %	4.3 %	5.0 %	5.6 %
2013	2014	2015	2016	2017	2018	2019	2020
5.7 %	6.1 %	4.6 %	6.4 %	5.3 %	4.7 %	0.7 %	n/a

The total escalation of the unit rates since January 2005 is 115.9% (i.e. 1.034 x 1.046 x 1.072 ... etc.).

The updated DMR guideline rates (as at March 2019) were utilised in the closure cost calculation. These rates are provided in the detailed calculations included in Appendix B.

13.2.3 TIME, FEE AND CONTINGENCY COSTS

The following time, fee and contingency costs have also been included in the closure cost estimate based on SLR’s experience with similar projects.

Table 13-2: Time, fee and contingency costs

Description	Quantity and unit
Contingency	10.0%
P&G's	12.0%

13.3 CLOSURE COST CALCULATION

The closure cost calculation for the life of the project amounts to **R 1 934 647.24 (inclusive of VAT)**. The detailed calculations are included in Appendix B.

14. ANNUAL REHABILITATION PLAN

According to the Financial Provisioning Regulations, 2015 (GNR 1147), the objectives of the annual rehabilitation plan are to:

- Review concurrent rehabilitation and remediation activities already implemented;
- Establish rehabilitation and remediation goals and outcomes for the forthcoming 12 months, which contribute to the gradual achievement of the post-mining land use, closure vision and objectives identified in the holder's final rehabilitation, decommissioning and mine closure plan;
- Establish a plan, schedule and budget for rehabilitation for the forthcoming 12 months;
- Identify and address shortcomings experienced in the preceding 12 months of rehabilitation; and
- Evaluate and update the cost of rehabilitation for the 12 month period and for closure, for purposes of supplementing the financial provision guarantee or other financial provision instrument.

Once environmental authorisation for the proposed project has been obtained, and the construction phase underway, then the annual rehabilitation plan for the forthcoming 12 months will be prepared. Rehabilitation and remediation activities associated with the annual rehabilitation plan will focus primarily on:

- Clearing of vegetation in accordance with the BAR for areas that are currently undisturbed;
- Destroying and disturbing as little vegetation and biodiversity as possible (i.e. maintaining a small 'construction buffer zone'), and retaining as much natural vegetation as possible;
- Stripping and stockpiling of soil resources from the footprint of the WRD extension;
- Establishment of dust suppression techniques; and
- Waste collection, storage and disposal.

15. MONITORING, AUDITING AND REPORTING

15.1 PRE-CLOSURE MONITORING, AUDITING AND REPORTING

The environmental specialist will conduct internal audits against the commitments in the EMPr. Pre-closure monitoring will be done in line with the proposed monitoring programme outlined in the BAR (SLR, April 2019).

In accordance with Regulation 55 of Mining Regulation 527 (23/04/2004), and Regulation 982 of the National Environmental Management Act (107 of 1998) (NEMA) (4/12/2014), an independent professional will conduct a performance assessment every 2 years. The site's compliance with the provisions of the BAR and the adequacy of the BAR is assessed in the performance assessment.

In accordance with the Financial Provisioning Regulations, 2015 (GNR 1147), financial provision for closure, as well as, unforeseen premature closure will be updated on an annual basis. This update will be carried out by external and independent environmental consultants.

All costs associated with pre-closure monitoring, auditing and reporting are assumed to be covered under the operational expenditure of the mining operations, and have not been included in this report.

15.2 POST-CLOSURE MONITORING, AUDITING AND REPORTING

Post-closure care and maintenance, auditing and reporting will comprise:

- Post-closure care and maintenance activities for a 2 to 3 year period as outlined below;
- The continuation of external EMP performance assessments by an independent professional until such time as a closure application is applied for; and
- The continuation of annual financial provision updates by external and independent environmental consultants until such time as a closure application is applied for.

Table 15-1: Post closure aftercare and maintenance programme

Rehabilitation targets	Method of monitoring	Frequency of monitoring	Aftercare and maintenance period	Actions to be taken if target is not reached
Vegetation cover	Visual biodiversity inspections by a qualified person to ensure that vegetation cover has re-	Annual monitoring	Aftercare and maintenance will take place for 2 to 3 years.	If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the soil will need to be analysed and the area be seeded with a seed mix of indigenous species

Rehabilitation targets	Method of monitoring	Frequency of monitoring	Aftercare and maintenance period	Actions to be taken if target is not reached
Erosion control	Visual inspections to ensure that erosion gulley's have not developed	Annual monitoring	Aftercare and maintenance will take place for 2 to 3 years.	Erosion management measures and/or mitigation measures to be confirmed through ongoing field trials.
Removal of alien and invasive species	Visual biodiversity inspections by a qualified person to ensure that alien invasive species have not established	Annual monitoring	Aftercare and maintenance will take place for 2 to 3 years.	All illegal invader plants and weeds shall be dealt with as required in terms of the relevant legislation.

The vegetative cover monitoring programme is designed to verify that rehabilitated areas are successfully developing a productive, self-sustaining ecosystem, which facilitates the post closure land use. The success of the vegetative cover is an important aspect in rehabilitation because of its impact on other parameters such as the extent of soil development, soil chemistry and surface erosion (by water and wind).

The major potential concerns with vegetative cover on rehabilitated areas are related to the adequacy of ground cover, the overall density of tree/shrub (woody) species and species composition (promote the growth of indigenous species and limit the spread of alien invasive species). The vegetative cover monitoring programme has been designed to evaluate these parameters where appropriate to ensure long-term environmental protection and the suitability of rehabilitated areas for post closure land use.

Further detail pertaining to the vegetation monitoring programme is provided below. The success of the monitoring programme will be evaluated taking into account the vegetation cover indicators outlined in Section 12.

15.2.1 Vegetation cover analysis

The adequacy of vegetative ground cover in providing effective erosion control, habitat establishment and soil building for post closure land uses is related to the percentage of ground surface covered by vegetation and its products. Analysis of the percentage of vegetative cover involves determining the percentage of ground surface that falls under the live parts of plants (the crown cover) or the aerial parts plus the mulch (the basal cover). The Notched Boot Method can be utilised for determination of the percentage of vegetative cover on rehabilitated areas, however the latest developed methods must also be considered in order to ensure the best procedure is used.

15.2.2 Tree/shrub density analysis

The density of tree and shrub (woody) species on rehabilitated areas provides an indication of the success of efforts in re-establishing a diverse forest/bush environment for post closure land use. A direct count of woody species within belt transects is utilised to determine the density of woody species on rehabilitated areas. Selected transects used in the rehabilitated areas for analysis of vegetative cover percentage will be utilised for determining woody species density. A 2 m wide by 100 m long rectangular plot centred on each transect line selected will be demarcated and the number of plants of woody species that are rooted in each plot will be counted, even if not all of an individual plant's aerial canopy is within the plot. Likewise, plants whose aerial

canopy overlap the plot but are not rooted within the plot will not be counted. This method is effective in determining woody species density in areas of low to semi-dense stands of vegetation.

15.2.3 Species composition analysis

The composition of indigenous species (and/or common commercial species due to previous farming activity) within rehabilitated areas also provides an indication of the success of revegetation efforts in re-establishing a diverse bush environment which is similar to that found in nearby undisturbed areas, thereby ensuring similar productive capability of the rehabilitated area for post closure land use. A direct count of vegetative species composition is undertaken on portions of selected belt transects utilised for analysis of woody species density in order to determine the percentage of indigenous species (and/or common commercial species due to previous farming activity) growing on rehabilitated areas.

All vegetation rooted within a representative 5 m long section of each belt transect selected will be identified and classified as either indigenous/common commercial or alien.

15.2.4 Historic reference sampling in reference areas

Representative vegetation reference plots (with similar/identical land uses as per the proposed post closure land use of rehabilitated mine areas) will be demarcated areas near rehabilitated mine areas for determining the degree of achievement of rehabilitation success criteria for vegetative cover. This procedure, known as historic record sampling, provides an indication of the percentage of ground cover, woody species density and percentage of indigenous species found in undisturbed areas. Vegetative growth on reference plots will be compared with the vegetation on rehabilitated areas. These reference areas will be at least 2500 m² in size. Analysis of vegetative cover percentage, tree/shrub density, and percentage of indigenous species will be undertaken on each reference plot.

The results of these analyses will be compared with the results of similar analyses on rehabilitated areas as described in Sections 15.2.1, 15.2.2 and 15.2.3 to determine the degree of achievement of rehabilitation success for vegetative cover.

15.2.5 Vegetation monitoring schedule

Vegetative cover monitoring will begin one year after completion of revegetation activities and continue annually until rehabilitation success for vegetative cover is achieved. Assessments will be done by trained staff under the supervision of a qualified professional. Vegetative cover monitoring will be completed each year during the seasonal period of peak standing biomass.

Should vegetative cover monitoring after the first year of the aftercare period on any rehabilitated area indicate that the vegetation in that area is not developing in a manner that will lead to achieving vegetative cover success criteria, then necessary remedial measures will be undertaken to enhance vegetative growth in that area to the extent that required standards can be expected to be met.

Rehabilitation success for the vegetative cover will be demonstrated when the following criteria are met:

- The percentage of basal cover on rehabilitated areas is greater than or equal to 8%;
- The density of tree/shrub species (expressed as woody plants per ha) on rehabilitated areas is greater than or equal to 80% of the density of tree/shrub species found on corresponding reference plots with a similar land use;
- Species composition is similar to the species composition of nearby reference plots;
- No Category 1 alien invasive plant species occur on site; and

- Achievement of the rehabilitation success criteria for vegetative cover will ensure that a productive, self-sustaining vegetative community has been established which facilitates a sustainable post closure land use.

16. CONCLUSION

South32 operates the open pit manganese (MMT) located on portion 5 and 6 of the farm Goold 329, the farm Sinterfontein 748, portion of portion 2 (Currently Portion 17) and portion of portion 1 (Currently Portion 16) of the farm Mamatwan 331, portion 3 of the farm Moab 700 and portion 4 of the farm Adams 328 (Figure 1).

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.

This report provides a preliminary closure plan and financial provision for the development of the proposed project. This report has been compiled 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).

Based on preliminary closure costs outlined in this document, the updated financial provision is calculated at R 1 934 647.24 (inclusive of VAT) and meets the 70% accuracy requirement. 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.



Natasha Smyth
(Report Author)



Steve van Niekerk
(Project Manager)



Alex Pheiffer
(Reviewer)

17. REFERENCES

DMR. 2005. Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine. January 2005.

GNR 982 of the National Environmental Management Act (107/1998). Environmental Impact Assessment Regulations, 2014. December 2014.

National Environmental Management Act (107/1998): Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations, published 20 November 2015, GNR 1147.

SLR, Basic Assessment Report and Environmental Management Programme Report for the Merging of the Mamatwan Sinterfontein Waste Rock Dump and the Tshipi Eastern Waste Rock Dump, April 2019.

Statistics South Africa (StatsSA).

Appendix A: Curriculum Vitae

CURRICULUM VITAE



NATASHA SMYTH

ENVIRONMENTAL ASSESSMENT PRACTITIONER

EMPA, South Africa

QUALIFICATIONS

BSc Hons 2008

Geography and Environmental Management

BSc 2007

Environmental and Biological Sciences

EXPERTISE

- Management and facilitation of permitting and licensing processes
- Management of stakeholder engagement processes
- Overall Project Management

Natasha is an environmental practitioner with SLR's South Africa office and is responsible for various environmental assessment projects. Natasha has ten years of experience within the Minerals sector, both as a project manager and assistant to various projects in South Africa and Africa.

Natasha has managed and assisted in a wide range of Environmental Impact Assessment projects for major and small scale minerals developments throughout South Africa as well as in Namibia for many of the major operators within the minerals industry.

Since 2009 Natasha has been involved in over 40 projects of which she has project managed 8 major and numerous small scale Environmental Impact Assessments for minerals extraction operations

PROJECTS

Key aspects of Natasha's recent project experience are summarised below.

Minimum Air Quality Emissions Standard Postponement Application for Anglo American Platinum's Polokwane (Limpopo Province), Waterval (North West Province) and Mortimer Smelter (Limpopo Province) operations (2018 to 2019)

Project Manager. Management of Stakeholder Engagement Process as part of an Air Quality Minimum Emissions Standards Postponement Application Process for the Waterval, Polokwane and Mortimer Smelter Complexes.

Minimum Air Quality Emissions Standard Postponement Application for the Zondereinde Northam Platinum Mine in the Limpopo Province in the Limpopo Province (2018 to 2019)

Project Manager. Management of Stakeholder Engagement Process as part of an Air Quality Minimum Emissions Standards Postponement Application Process for the Zondereinde Smelter Complex.

<p>Integrated Water Use Licence Application for the Lehating manganese mine in the Northern Cape Province (2018 - 2019)</p>	<p>Project Manager. Compilation of the Integrated Water and Waste Management Plan, Water Use Licence Application forms and the management of specialists in support of the Lehating Integrated Water Use Licence Application.</p>
<p>Integrated Water Use Licence Application for the new Khwara manganese mine in the Northern Cape Province (2018 - 2019)</p>	<p>Project Manager. Compilation of the Integrated Water and Waste Management Plan, Water Use Licence Application forms, the management of specialists and authority liaison in support of the Khwara Integrated Water Use Licence Application.</p>
<p>Monthly environmental support for the Tshipi Borwa Mine (2018 – 2019)</p>	<p>Project Manager. Off-site environmental support work.</p>
<p>Financial Provision for Infrastructure Changes at the Zondereinde Northam Platinum Mine in the Limpopo Province (2018)</p>	<p>Project Manager. Compilation of the financial provision report for infrastructure changes at the Zondereinde Smelter Complex as part of a basic assessment process for changes to infrastructure at the smelter.</p>
<p>EMP commitments consolidation of the Tshipi and Mamatwan Mine for the mining of the barrier pillar in the Northern Cape Province (2018)</p>	<p>Project Manager. Compilation of a barrier pillar mining commitments report to outline the collective environmental management programme, integrated water use licence and environmental authorisation commitments for both Tshipi and South32 specifically for the mining of the barrier pillar.</p>
<p>ESIA for the retreatment of copper tailings dams in the town of Kitwe in Zambia (2017 - 2018)</p>	<p>Project Manager. Compilation of scoping report and terms of reference. Compilation of the environmental and social impact assessment report to meet IFC requirements. Management of multi-disciplinary specialist studies. Co-ordination of specialist teams within Zambia and South Africa. Management of stakeholder engagement process.</p>
<p>Environmental compliance audit for the Sishen Dingelton resettlement site in the Northern Cape Province (2017)</p>	<p>Project Manager. Assess compliance with the conditions outlined in the environmental authorisation and the approved environmental management programme.</p>
<p>Environmental compliance audit for the Sishen Dingelton decommissioning site in the Northern Cape Province (2017)</p>	<p>Project Manager. Assess compliance with the conditions outlined in the environmental authorisation and the approved environmental management programme.</p>
<p>Atmospheric Emissions Compliance Audit for the Zondereinde Northam Platinum Mine in the Limpopo Province (2017)</p>	<p>Project Manager. Assess compliance with the conditions of the atmospheric emissions licence for the Zondereinde Mine and report compilation.</p>
<p>Environmental compliance audit for the Northam Platinum Mine in the Limpopo Province (2017)</p>	<p>Project Manager. Undertake an environmental compliance audit of the Zondereinde Mine in terms of applicable legislation and report compilation.</p>
<p>Independent Peer Review of the Vaal Gamagara Water Supply Scheme in the Northern Cape Province (2017)</p>	<p>Project co-ordinate. Management of specialists and review of environmental permitting aspects and assistance with report compilation.</p>

<p>Due diligence for a smelter complex and associated mine located in the North West Province (2016- 2017)</p>	<p>Project Manager. Team co-ordination and compilation of due diligence report</p>
<p>EIA and EMP for the development of the new Khwara underground mine in the Northern Cape Province (2016-2017)</p>	<p>Project Manager. Compilation of scoping and environmental impact assessment and environmental management programme reports. Management of specialists and stakeholder engagement process and compilation of the financial provision report.</p>
<p>Environmental assessment process to cater for changes to the approved infrastructure layout at the Tshipi Borwa Mine in the Northern Cape Province (2012-2017)</p>	<p>Project Manager. Compilation of scoping and environmental impact assessment and environmental management programme reports. The management of the stakeholder engagement process and specialists.</p>
<p>Preliminary close out audit for the Sishen Mine Dingleton Resettlement site near Kathu in the Northern Cape Province (2016)</p>	<p>Project Manager. Assess compliance with the conditions outlined in the environmental authorisation and the approved environmental management programme.</p>
<p>Update of the basic assessment report for the establishment of a diesel generator as part of dewatering infrastructure at the Evander No. 6 Shaft complex in the Mpumalanga Province (2016)</p>	<p>Project Manager. Update the basic assessment report to comply with the DMR report template</p>
<p>Environmental assessment process and air emissions license process for the establishment of the new Jeanette Mine in the Free State Province (2015-2016)</p>	<p>Project Manager. Compilation of scoping and environmental impact assessment and environmental management programme reports. Compilation of the technical supporting information required for a waste management license application and an air emissions license application. The management of the stakeholder engagement process and specialists.</p>
<p>Water Use License Compliance Audit for the UMK Mine in the Northern Cape Province (2015 - 2016)</p>	<p>Project Manager. Assess compliance with the commitments included in the water use licenses issued and make recommendations for rectifying non-compliances and partial compliances identified during the audit.</p>
<p>Basic Assessment for undertaking prospecting related activities for Impala Platinum Mine in the North West Province (2015 -2016)</p>	<p>Project Manager. Compilation of basic assessment report, management of specialists, management of stakeholder engagement process.</p>
<p>Environmental compliance audit for the UMK Mine in the Northern Cape Province (2015 -2016)</p>	<p>Project Manager. Assess compliance with the conditions outlined in the environmental authorisation and the approved environmental management programme.</p>

<p>Environmental assessment process, waste management license process and water use license process for the establishment of a new Mokala Manganese Mine in the Northern Cape Province (2014-2016)</p>	<p>Project Manager. Compilation of scoping and environmental impact assessment and environmental management programme reports. Compilation of the technical supporting information required for a water use license application process and submission of the waste management license application. The management of the stakeholder engagement process and specialists.</p>
<p>Environmental assessment process for the proposed construction of dewatering infrastructure and the development of a decant water pipeline in support of the proposed Evander Shaft 6 Gold in the Mpumalanga Province (2014)</p>	<p>Project Manager. Compilation of a basic assessment report, the management of the stakeholder engagement process and the management of specialists.</p>
<p>Environmental legal gap analysis for Rappa Resources in the Gauteng Province (2014)</p>	<p>Project Manager. Compilation of an environmental legal gap analysis report to identify any inadequacies in existing approvals and to identify outstanding approvals in terms of the National Environmental Management Act 107 of 1998, the National Environmental Management: Waste Act 59 of 2008, the National Environmental Management: Air Quality Act 39 of 2004, and the National Water Act 36 of 1998 (NWA).</p>
<p>Environmental support work to meet the requirements of the approved environmental management programme and updating the water use license application for the UMK Mine in the Northern Cape Province (2009-2014)</p>	<p>Project Manager. Environmental support with regards to assistance to the UMK Mine in implementing its environmental management programme commitments. This also includes quarterly stakeholder engagement processes, EMP performance assessments and quarterly audits. Updating the water use license and supporting documentation including a new integrated water and waste management plan and specialist management</p>
<p>Environmental Management Programme amendment for the Nooitgedacht Sand Quarry Mine in the Gauteng Province (2013)</p>	<p>Project Manager. Compilation environmental impact assessment and environmental management programme amendment report.</p>
<p>Proposed Kinsenda project amendment: underground mine and surface infrastructure for Meterox, Kinsenda Copper mine in the DRC (2013)</p>	<p>Project assistant. Assistance with the compilation of the environmental impact assessment and environmental management programme report.</p>
<p>The environmental assessment process to amend the existing environmental impact assessment report and environmental management programme report to cater for infrastructure changes as the Leeuwkop Platinum Mine in the North West Province (2012-2013)</p>	<p>Project Manager. Compilation of scoping and environmental impact assessment and environmental management programme amendment reports. Submission of the waste management license application. The management of the stakeholder engagement process and specialists.</p>

<p>Environmental and social impact overview of the proposed development of a new training centre at the Impala Platinum Rustenburg Operation in the North West Province (2013)</p>	<p>Project Manager. Compilation of a report to provide an overview of the potential environment and social impacts associated with the development of the proposed training centre.</p>
<p>Environmental Management Programme performance assessment of the Impala Rustenburg Operation in the North West Province (2012)</p>	<p>Project assistant. Assistance with the on-site auditing and report writing required for the environmental management programme performance assessment</p>
<p>Prospecting environmental management plan renewal and amendment Afplats in the North West Province (2012)</p>	<p>Project Manager. Compilation of the reports required for the renewal of a prospecting right, the amendment of an approved prospecting environmental management plan including the update of the financial provision and the management of the stakeholder engagement process.</p>
<p>Prospecting environmental management plan renewal and amendment (Impala Platinum Limited on behalf of Inkosi Platinum in the North West Province (2012)</p>	<p>Project Manager. Compilation of the reports required for the renewal of a prospecting right, the amendment of an approved prospecting environmental management plan including the update of the financial provision and the management of the stakeholder engagement process.</p>
<p>Prospecting environmental management plan amendment Ntsimbintle Mining (Pty) Ltd in the Northern Cape Province (2012)</p>	<p>Project Manager. Compilation of the prospecting environmental management plan amendment report and specialist management.</p>
<p>The consolidation of Impala’s fourteen existing approved environmental management programme reports into one consolidated report in the North West Province (2012)</p>	<p>Project Manager. Compilation of a consolidated environmental impact assessment and environmental management programme report include the management of the stakeholder engagement process</p>
<p>Environmental evaluation of Pit8C at Impala Platinum in the North West Province (2012)</p>	<p>Project Manager. Compilation of a report to evaluate if the approved EIA and EMP amendment report adequately caters for the proposed Pit8C conventional opencast mining area, in terms of the baseline environment, the impact assessment and the mitigation/management measures.</p>

<p>Environmental assessment process for the environmental impact assessment and environmental management programme amendment for a proposed new tailings dam, re-processing of an old tailings dam, rehabilitation of the old tailings and waste disposal site, and open pit expansion for Impala Platinum Limited (Rustenburg Operation) in the North West Province (2011-2012)</p>	<p>Project Manager. Compilation of scoping and environmental impact assessment and environmental management programme reports. Compilation of the technical supporting information required for a water use license application process. The management of the stakeholder engagement process and specialists</p>
<p>EIA and EMP for the establishment of the Swakop Uranium Mine in Namibia (2011)</p>	<p>Project assistant. Project assistant with stakeholder engagement and managing specialists.</p>
<p>EIA and EMP for the establishment of the new Husab Uranium Mine in Namibia (2011)</p>	<p>Project assistant. Project assistant with stakeholder engagement and managing specialists.</p>
<p>EIA and EMP for the linear infrastructure associated with the Swakop Uranium Mine in Namibia (2010-2011)</p>	<p>Project assistant. Project assistant with stakeholder engagement and managing specialists.</p>
<p>Environmental assessment process for the establishment of the new Turquoise iron ore mine in the Limpopo Province (2010-2011)</p>	<p>Project assistant. Assistance with the stakeholder engagement process.</p>
<p>Environmental assessment process (2010)</p>	<p>Project assistant. Assistance with the compilation of the environmental impact assessment and environmental management programme report.</p>
<p>Environmental assessment process for the establishment of the new Kalkfontein Platinum Mine in the Limpopo Province (2010)</p>	<p>Project assistant. Assistance with the stakeholder engagement process.</p>
<p>Prospecting EMP for platinum group metals for Braggite Resources in the Mpumalanga Province (2010)</p>	<p>Project manager. Compilation of a prospecting EMP and stakeholder management process.</p>
<p>Compilation of the EIA and EMP reports for the Lonshi Copper Mine located in the DRC (2009-02010)</p>	<p>Project Assistant. Assistance with the compilation of the EIA and EMP reports for the Lonshi Copper Mine</p>
<p>Licensing of various water uses at the South Deep Mine in the North West Province (2009)</p>	<p>Project assistant. Assistant with water use licensing application.</p>

<p>Stakeholder engagement process for the Everest Platinum Mine as part of an EMP amendment to the extension of mining activities and changes to surface infrastructure in the Mpumalanga Province (2009)</p>	<p>Project assistant. Assistance with the stakeholder engagement process.</p>
<p>Stakeholder engagement process for the EIA and EMP amendment process for the new Northern Cape Manganese Company Mine (2009)</p>	<p>Project assistant. Assistance with the stakeholder engagement process.</p>

CURRICULUM VITAE



STEPHEN VAN NIEKERK PR. ENG.

TECHNICAL DIRECTOR (CLOSURE & REHABILITATION)

Mine Waste Engineering, Africa

QUALIFICATIONS

NEBOSH	2015	International General Certificate in Occupational Health and Safety
SAFETRAC	2014	Safety Management Training Certificate
Pr. Eng.	2001	Professional Engineer, Engineering Council of South Africa (ECSA) , # 20010256
MSc (Civil)	2000	Civil Engineering, University of the Witwatersrand, South Africa
BSc (Civil)	1995	Civil Engineering, University of the Witwatersrand, South Africa

EXPERTISE

- Mine closure liability estimates
- Mine closure and rehabilitation planning
- Design of mine residue deposits (MRD's)
- Construction supervision and operations management of MRD's
- Flood hydrology
- Health and safety management

Stephen has over 20 years' consulting experience and is currently the technical director responsible for the development and management of SLR's closure and rehabilitation team across South Africa and Africa. He has been with SLR (previously called Metago Environmental Engineers) since 2002. During this time his work has focussed primarily on:

- The development of mine closure plans, environmental risk assessments and the estimating of mine closure and rehabilitation liabilities.
- The design, construction supervision, operations management and closure of MRD's (i.e. tailings storage facilities, heap leach pads and waste rock dumps).

Stephen was previously a company director from 2007 to 2016, and he was also responsible for the development and management of the health and safety system within SLR's South Africa and Africa operations from 2011 to 2016. Prior to 2002 he worked as an engineering graduate and an assistant resident engineer for Knight Piesold specialising in the design, construction and operation of MRD's. He has been registered as a professional engineer in South Africa since 2001.

MINE CLOSURE PROJECTS

Preliminary Mine Closure Plans, Environmental Risk Assessments, Annual Rehabilitation Plans and Closure Liability Estimates.

Mostly for ESIA/ESMP reports and amendments. For submission to the DMR or other Local Authorities.

In accordance with the Financial Provisioning Regulations, 2015/2017.

Projects in South Africa:

2016 - 2018	Tshipi Borwa Manganese Mine. For Tshipi é Ntle Manganese Mining.
2017	Evander 6 Shaft Project. For Taung Gold.
2017	Khwara Managense Mine. For Khwara Managanese.
2016, 2017	UMK Manganese Mine. For United Manganese of Kalahari.
2016	Jeanette Gold Mine. For Taung Gold.
2016	Siyanda Ferrochrome Smelter. For Siyanda Chrome Smelting Company.
2016	Alexander Coal Mine. For Anglo American Inyosi Coal.

Projects elsewhere in Africa:

2018	Husab Uranium Mine. For Swakop Uranium (Namibia).
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	2017	Otjikoto Gold Mine. For B2Gold (Namibia).
<p>Mine Closure Bi-Annual and/or Annual Liability Updates.</p> <p>For the DMR and/or company accounting purposes.</p> <p>(From 2012 to date only)</p>	Projects in South Africa:	
	2012 - 2018	Tharisa Platinum Mine. For Tharisa Minerals.
	2012 - 2018	Tshipi Borwa Manganese Mine. For Tshipi é Ntle Manganese Mining.
	2012 - 2018	UMK Manganese Mine. For United Manganese of Kalahari.
	2016 - 2018	Morokwa Manganese Mine. For National Manganese Mines.
	2018	Vanggatfontein Coal Mine. For Wescoal.
	2018	Velddrift Saltworks. For Velddrift Salt Company.
	2018	Morula PGM Plant. For Hernic Ferrochrome.
	2012 - 2017	Pilanesberg Platinum Mine. For Pilanesberg Platinum Mines.
	2014 - 2017	Sedibelo Platinum Mine. For Itereleng Bakgatla Mineral Resources.
	2012 - 2017	Vanggatfontein Coal Mine, Vaalkrantz Coal Mine, Boomlaer Siding, and Moabsvelden Coal Project. For Keaton Mining.
	2017	Jeanette Gold Mine, and Evander 6 Shaft Project. For Taung Gold.
	2012 - 2015	Lesedi Chrome Mine, Sky Chrome Mine, and Rooderand Chrome Operations. For International Ferro Metals.
	2014, 2015	Morula Chrome Mine, and Bokone Chrome Mine. For Hernic Ferrochrome.
	2014, 2015	Marikana Platinum Mine, Kroondal Platinum Mine, and Everest South Platinum Mine. For Aquarius Platinum.
	2014, 2015	Kudumane Manganese Mine. For Kudumane Manganese Resources.
		Projects elsewhere in Africa:
	2018	Kombat Copper Mine. For Manila Investments (Namibia).
	2013 – 2018	Husab Uranium Mine. For Swakop Uranium (Namibia).
<p>Mine Closure Liability Assessments for ESIA/ESMP reports and amendments.</p> <p>For submission to the DMR or other Local Authorities.</p> <p>(From 2012 to date only)</p>	Projects in South Africa:	
	2018	PPM Plant Expansion. For Pilanesberg Platinum Mines.
	2018	Zondereinde Mine Smelter. For Northam Platinum.
	2015, 2018	Mokala Manganese Mine. For Mokala Manganese.
	2015, 2016	COZA Iron Ore – Driehoekspan Project, and Jenkins Project. For COZA Mining.
	2015	Jeanette Gold Mine Project. For Taung Gold.

	2015	Commissiekraal Coal Project. For Tholie Logistics.	
	2014	Kudumane Manganese Mine. For Kudumane Manganese Resources.	
	2012, 2014	Sedibelo Platinum Mine. For Itereleng Bakgatla Mineral Resources.	
	2012	PPM Chrome Mine, and Magazynskraal Platinum Mine. For Pilanesberg Platinum Mines.	
	2012	Hoogland Extension, and Project Fairway. For Aquarius Platinum.	
	Projects elsewhere in Africa:		
	2013, 2016	Manica Gold Project. For Auroch Minerals NL /Xtract Resources (Mozambique).	
	2013, 2014	Kinsenda Copper Mine, and Musonoi Copper Mine. For Metorex (DRC).	
	2013, 2014	Letlhakane Diamond Mine Tailings Resource Treatment Project. For Ecosurv Environmental Consultants (Botswana).	
	2013	Omitiomire Copper Mine. For Craton Mining and Exploration (Namibia).	
3 rd Party Review of Closure Liability Estimates and/or QRA. For company accounting purposes and/or transactional due diligence.	Projects in South Africa:		
	2018	Thabazimbi Iron Ore Mine. For Sishen Iron Ore Company.	
	2016	2 x Chrome Mines. Confidential Client.	
	2015	Thabazimbi Iron Ore Mine. For ArcelorMittal.	
	2010	Zinc Mine. Confidential Client.	
	2010	Impala Platinum Rustenburg Operations. For Impala Platinum.	
	2008	15 x Gold TSF's. Confidential Client.	
	Projects elsewhere in Africa:		
	2018	2 x Gold Mines. Confidential Client (Senegal, Burkino Faso).	
	2010	Zinc Mine. Confidential Client (Namibia).	
	Preliminary Mine Closure Plan and Closure Liability Estimates (prior to Financial Provisioning Regulations, 2015). For company accounting purposes and/or submission to Local Authorities.	Projects in South Africa:	
		2003	Oaks Diamond Mine. For De Beers.
		Projects elsewhere in Africa:	
2003, 2009, 2015		Botash Soda Ash Operations. For Botswana Ash (Botswana).	
2005, 2015		Damang Gold Mine. For Abosso Goldfields (Ghana).	
2015		Tarkwa TSF3. For Goldfields Ghana (Ghana).	

MRD & FLOOD HYDROLOGY PROJECTS	Projects in South Africa:	
Evander 6 Shaft Project	2011 - 2017	Conceptual and bankable TSF and WRD designs, and storm water management. For Taung Gold.
AMT's Chrome Operations	2013	Legal compliance review of TSF's. For African Mining and Trust Company.
Tharisa Platinum Mine	2012	Conceptual design of future WRD's. For Tharisa Minerals.
Goldfields Group	2010, 2012	Analysis of present and future stability of TSF's. For Gold Fields South Africa Group Operations.
Spitzkop Platinum Mine	2007 - 2012	Detailed TSF design, construction specifications, contract document and part-time construction supervision. For Eastplats.
Turquoise Moon Iron Project	2011	Conceptual and bankable TSF design, and storm water management for ESIA/ESMP and feasibility study. For Ferrum Crescent.
AngloGold Ashanti	2010	Review of stability of TSF's at Vaal River Operations. For AngloGold Ashanti.
Kalkfontein Platinum Mine	2009	Conceptual TSF design, and storm water management for ESIA/ ESMP study. For Kameni.
Voorspoed Diamond Mine	2007 - 2008	Recommended operations management, Code of Practice compilation, and construction supervision of thickened tailings / paste facility and WRD. For De Beers / Murray and Roberts.
Crocodile River Platinum Mine	2007 - 2008	TSF and RWD safety monitoring inspections, RWD registration and recommended operations management. For Eastplats.
Voorspoed Diamond Mine	2005 - 2007	Detailed design and construction specifications for thickened tailings / paste facility and WRD. For Murray and Roberts / De Beers.
Crocodile River Platinum Mine	2004 - 2007	TSF audit, TSF and RWD safety monitoring inspections, Code of Practice, conceptual deposition strategy and design for IWWMP. For Eastplats.
Dominion Reef Uranium Mine	2006	Audit of TSF. For SRK Consulting.
Blyvooruitzicht Gold Mine	2005	Inspection and review of dormant TSF's adjacent to new township development. For Schwartz Tromp and Associates.
Everest South Platinum Mine	2002	Bankable TSF feasibility study. For Aquarius Platinum.
RCM Chrome Mine	2000 - 2002	Detailed TSF design, contract documentation, tender adjudication, construction supervision, dam complex safety monitoring inspections, Code of Practise. For Bayer.
Vergenoeg Flourspar Mine	2000 - 2002	TSF and RWD safety monitoring inspections, stability analyses, design of remedial measures and recommended operations management. For Metorex.
Rooiwal Power Station	2000 - 2002	Ash dam safety monitoring inspections. For Pretoria City Council.

BRPM Platinum Mine	1998 - 2000	TSF risk assessment, stability analyses, construction supervision, dam safety monitoring inspections, recommended operations management. For Anglo Platinum.
Durnacol Coal Mine	1997 - 1999	Conceptual and detailed design of coal discard complex, pollution control investigations and rehabilitation optimisation. For Iscor Mining.
Transalloys Slag Treatment Project	1998	Detailed TSF design, contract documentation, construction supervision and hand-over. For Titaco Projects.
Driefontein Wastewater Treatment Works	1997 - 1998	Detailed design of Spills dam, contract documentation, construction supervision and hand-over. For Greater Johannesburg Metropolitan Council.
Klipwal Gold Mine	1997 - 1998	TSF stability analyses, design of remedial measures and recommended operations management. For Duiker Mining.
Heritage Coal Mine	1997	Detailed design of discard dump and rehabilitation optimisation. For Duiker Mining.
Projects elsewhere in Africa:		
Bokouma Uranium Mine	2007 - 2009	Stream diversion design (incl. hydrological and geotechnical investigation) for bankable feasibility study. For Uramin Inc. (Central African Republic).
Farim Phosphate Mine	2007	Hydrological investigation for ESIA/ESMP. For Time Mining (Guinea Bissau).
Tarkwa Gold Mine	2003 - 2007	Contract documentation, tender adjudications, construction supervision, spillage containment / flood routing investigation for numerous heap leach pads. For Goldfields Ghana (Ghana).
Liqhobong Diamond Mine	2004 - 2005	Geotechnical site investigation and storm water control design for TSF design. For European Diamonds PLC (Lesotho).
Lubengle Copper Mine	2001	Recommended TSF operations management. For Konkola Copper Mines (Zambia).
MEMBERSHIPS		
LaRSSA	Member of the Land Rehabilitation Society of South Africa (LaRSSA)	
GIGSA	Member of the International Geosynthetics Society – South African Chapter (GIGSA)	
PUBLICATIONS		
Civil Engineering Magazine	Van Niekerk, S., 2014, "Questions around Mine Closure", Civil Engineering Magazine, Vol. 22 No. 7, South African Institution of Civil Engineering, August 2014.	
Mining Magazine	Interviewed and quoted in "Closing the Deal", Mining Magazine, December 2013.	
SA Career Focus Magazine	Interviewed and quoted in "Environmental Engineer", SA Career Focus Magazine, Vol. 5 No. 8, May 2011.	
Civil Engineering Magazine	James, A., Van Niekerk, S., and Stobart, B., 2005, "Mine Closure Planning – Time for a Holistic Approach", Civil Engineering Magazine, Vol. 13 No. 8, South African Institution of Civil Engineering, August 2005.	

Civil Engineering Magazine

Marsden, R., Van Niekerk, S., and Kachrillo, J., 2003, "*Harnessing the Forces of Nature – Active Barrier Technology*", Civil Engineering Magazine, Vol. 11 No. 7, South African Institution of Civil Engineering, August 2003.

CURRICULUM VITAE



ALESSANDRA (ALEX) PHEIFFER

SENIOR ENVIRONMENTAL CONSULTANT

Environmental Management, Planning and Approvals, Africa

QUALIFICATIONS

BSc	1998	Biological Sciences
BSc (Hons)	1999	Zoology
MSc	2004	Environmental Management

EXPERTISE

- Permitting and Licensing Processes
- Stakeholder Engagement
- Compliance Auditing
- Due Diligence and Reviews
- Screening and Risk Assessments
- Financial Provision and Closure Planning

Alex has 16 years' experience in the field of Environmental Management. She has managed a wide range of permitting and licensing projects including environmental, water, waste and air licensing and assessment processes mainly in the exploration, mining and industrial sectors. These included project management and co-ordination; specialist and engineering team management; co-ordination, facilitation and undertaking of stakeholder engagement processes including for contentious projects, and environmental assessment. She has experience in addressing both in-country legislation and Equator Principles and International Finance Corporation (IFC) requirements.

Alex has provided environmental specialist input on a number of pre-feasibility studies linked to the exploration/development/expansion of mining operations. She has also been involved in policy drafting, environmental due diligence processes, environmental reviews for financing institutions (in the mining, industrial and alternative energy sectors), compliance auditing, general environmental management support to operating sites, site screening exercises, risk assessments and financial provisioning and closure planning.

In her early career years, Alex held a position within Anglo Platinum's Waterval Smelter as Assistant to the Chief Environmental Officer. During the period March 2015 to October 2016, Alex held the position of Operations Manager: Environmental Management, Planning and Approvals (EMPA) within SLR Africa and was responsible for co-ordinating SLR's environmental management team.

PROJECTS

CHROME	
2007	Project Manager: EMPs (including an EIA) for prospecting on the farms Beestekraal 290 JQ, Boschpoort 284JQ, Nooitgedacht 289JQ and Nooitgedacht 287JQ near Rustenburg in the North West Province: Bakgatla Ba Kgafela Tribal Authority
2005	Project Manager: EMPs (including EIA) for two prospecting projects on the town and town lands of Rustenburg 272JQ in Rustenburg Magisterial District, North West Province: Xstrata South Africa (Pty) Ltd
2003-2004	Project Assistant: EIA/EMP for a chrome mine and concentrator in the Rustenburg / Boshhoek region: SA Ferrochrome and Mining (Pty) Ltd

COAL	
Current	Project Manager: EIA/EMP for a greenfields coal mine in northern Kwa-Zulu Natal: Commissiekraal Coal (Pty) Ltd
COPPER	
Current	Project Reviewer: ESIA for the Kitwe tailings retreatment and mineral processing project in Zambia: Horizon Mining
2014	Project Reviewer: EIA/EMP amendment for the Kinsenda operations in the DRC.
2013	Project Reviewer: EIA for a greenfields copper oxide project (Omitiomire project) (Namibia): Craton Mining and Exploration (Pty) Ltd
FERROCHROME	
2013	Project Manager: EIA/EMP amendment for the exclusion of smelter activities at Bokfontein Chrome Mine: Hernic Ferrochrome
2012	Project Manager: EIA/EMP amendment for a concentrator and smelter complex at Bokfontein Chrome Mine: Hernic Ferrochrome
2003-2004	Project Assistant: EIA for Project Lion, a new smelter complex near Steelpoort: Xstrata South Africa (Pty) Ltd
2002-2003	Project Assistant: EIA/EMP for Transvaal Ferrochrome Project (a ferrochrome smelter complex in the Rustenburg/Brits region):
2002-2003	Project Manager: EIA/EMP amendment for a pelletizing plant at Xstrata Wonderkop: Xstrata South Africa (Pty) Ltd
GOLD	
Current	Project Reviewer: EIA for the refurbishment of an existing shaft and related mineral processing and residue disposal facilities: Taung Gold
2016	Project Reviewer: Annual update of the Damang EMP and reclamation plan: Abosso Goldfields Limited
2012	Project Manager: EIA for a filtration plant at Navachab Gold Mine (Namibia): AngloGold Ashanti Namibia (Pty) Ltd
2011	Project Reviewer: Basic Assessment for Diesel storage facilities at its South Deep Mine Operations: God Fields (South Africa) (Pty) Ltd
2009	Part of a peer review delegation for an ongoing EIA: Participation in an integrated environmental management review – technical workshop for new projects at Gold Fields: Gold Fields (South Africa) (Pty) Ltd
2005-2007	Project Manager: Consolidating South Deep Min’s various EMPR documents into one document and in turn bringing the mine’s EMPR in line with the requirements of the Mineral and Petroleum Resources Development Act and supporting

	regulations : Placer Dome Westonaria Joint Venture – South Deep Mine
2005-2007	Project Manager: EIA and EMP amendment for a new tailings dam development: Placer Dome Westonaria Joint Venture – South Deep Mine
IRON	
2016	Project Reviewer: EIA and EMP for the Jenkins and Driehoekspan greenfields mining operations in the Northern Cape: Coza Iron Ore
2012	Project Manager: EIA/EMP for greenfield iron ore mine development near Lephalale (Ellisras) (Moonlight iron ore project) in the Limpopo Province: Turquoise Moon Trading (Pty) Ltd
2010	Project Manager and Reviewer: Amendment to existing prospecting EMP to cater for changes in prospecting operations: Nelesco 684 (Pty) Ltd
2010	Project Manager and Reviewer: Amendments to existing prospecting EMPs (Cascade 442IT and Delft 22HU) to cater for changes in prospecting operations: Mkhombi Mining (Pty) Ltd
2009	Project Manager and Reviewer: Management of the consultation process for a prospecting EMP on the farms Sterkfontein 419IT and Wolvernkop 427IT, near Piet Retief in Mpumalanga Province: Mkhombi Mining (Pty) Ltd
2009	Project Manager: EMP (including EIA) for prospecting on the farms Moabsvelden 248IR and Rietkuil 249IR, near Delmas in Mpumalanga Province: Spirapix Mining (Pty)
MANGANESE	
Current	Project Reviewer: a number of EMP amendment and rectification processes for Tshipi é Ntle Manganese Mining operations in the Northern Cape
Current	Project Reviewer: EMP amendment and rectification processes for UMK Manganese Mine in the Northern Cape
2017	Project Reviewer: EIA and EMP for a greenfields mining right application in the Northern Cape: Khwara Mining
2016	Project Reviewer: EIA and EMP for a greenfields mining right application in the Northern Cape: Ntsimbintle Mining (Pty) Ltd
2008 and 2016	Project Reviewer: EMP performance assessment and financial provision re-assessment for prospecting right in the Northern Cape: Ntsimbintle Mining (Pty) Ltd
PLATINUM	
Ongoing	Project Manager and Reviewer: Various EMP performance assessments and financial provision re-assessments for prospecting rights held by Impala in the North West, Mpumalanga and Limpopo Province: Impala Platinum Limited (Impala)
Ongoing	Project Manager: Various amendments to existing prospecting EMPs to cater for

	the changes in prospecting operations: Impala Platinum Limited (Impala)
Ongoing	Project Manager and Reviewer: Various EMP performance assessments and financial provision re-assessments for prospecting rights held by Afplats, Inkosi and Imbasa in the North West Province
Current	Project Reviewer: EIA and EMP for the relocation of a security perimeter and infrastructure footprint expansion at a BMR and Smelter complex in the Limpopo Province: Northam Platinum
2015-2016	Project Reviewer: EIA and EMP amendment including WML for changes to surface infrastructure and operations at Bakubung Platinum Mine, North West Province
2012-2015	Project Reviewer: EIA and EMP amendment for changes to surface infrastructure and operations at Tharisa Mine, North West Province
2014	Project Reviewer: EMP Compliance Audit for Leeuwkop Mine
2013	Project Manager and Reviewer: EIA/EMP amendment for changes to surface infrastructure at Marula Platinum Mine: Marula Platinum (Pty) Ltd
2013	Project Reviewer: EIA/EMP for the extension of underground mining activities at Everest Platinum Mine (Fairway project): Aquarius Platinum (South Africa) (Pty) Ltd
2013	Project Manager: EIA/EMP for the extension of mining activities at Everest Platinum Mine (Hoogland project): Aquarius Platinum (South Africa) (Pty) Ltd
2011	Project Co-ordinator: Supply and co-ordination of interim on-site environmental manager to assist with general management of environmental aspects at Everest Platinum Mine: Aquarius Platinum (SA) (Pty) Ltd
2010	Project Reviewer: Compilation of environmental documents (including a public consultation process) in support of a closure application for the Turffontein 263JQ and Kookfontein 265JQ prospecting right and Reinkoyalskraal 278JQ and Elandsheuwel prospecting right: Impala Platinum Limited (Impala)
2010	Project Reviewer and Auditing: 2010 Annual Re-Assessments of Everest Platinum Mine's closure cost estimate: Aquarius Platinum (SA) (Pty) Ltd
2010	Project Reviewer: EMP (including EIA) for prospecting on the farm Rooikraal 118JS in the Limpopo Province: Braggite Resource (Pty) Ltd
2009	Project Manager: 2009 Annual Re-Assessments of Everest Platinum Mine's closure cost estimate: Aquarius Platinum (SA) (Pty) Ltd
2009	Project Manager and Closure: EIA/EMP amendment for the north and south boxcuts at Everest Platinum Mine: Aquarius Platinum (SA) (Pty) Ltd
2009	Project Reviewer: EIA/EMP amendment for the production expansion of Eland Platinum Mine: Xstrata South Africa (Pty) Ltd
2008-2009	Project Manager: Assistance with the consultation with landowners to input into closure of a prospecting right: Impala Platinum Limited (Impala)

2008	Project Manager: Compilation of environmental posters linked to the seismic EMP for the use in environmental awareness training: Impala Platinum Limited (Impala)
2008	Project Manager and Reviewer: EMP performance assessment of Marula Platinum Mine's EMP report: Marula Platinum (Pty) Ltd
2007-2008	Project Manager: EIA/EMP for a new platinum mine and concentrator Plant (Mphahlele Project) in the Limpopo Province: Tameng Mining and Exploration (Pty) Ltd
2006-2009	Project Manager: EIA/EMP amendment for additional infrastructure at Everest Platinum Mine: Aquarius Platinum (SA) (Pty) Ltd
2006-2008	Project Manager: EIA/EMP for seismic survey activities near Impala's Rustenburg operations: Impala Platinum Limited (Impala)
2006-2008	Project Manager: EIA/EMP amendment for a new shaft and associated facilities and Marula Platinum Mine. This project also included the consolidation and updating of the mine's EMP to cater for the changes in mining legislation: Marula Platinum (Pty) Ltd
2005	Project Manager: EMP (including an EIA) for prospecting on the farms Turffontein 263JQ, near Impala's Rustenburg Operations: Impala Platinum Limited (Impala)
2005	Project Manager: EMP (including an EIA) for prospecting on the farm Reinkoyalskraal 278JQ, near Impala's Rustenburg Operations: Impala Platinum Limited (Impala)
2005	Project Manager: EMP (including and EIA) for prospecting on the farms Klipgatkop 115JQ, near Impala's Rustenburg Operations: Impala Platinum Limited (Impala)
2005	Project Manager: EMP (including and EIA) for prospecting on the farms, Doornspruit 84JQ and Roodekraalspruit 113JQ near Impala's Rustenburg Operations: Impala Platinum Limited (Impala)
2005	Project Manager: EIA/EMP for a mining right application (The Fingers Project) at Marikana Platinum Mine: Aquarius Platinum (SA) (Pty) Ltd
2004	Project Manager: Assisted in the facilitation of the public involvement process for the Shaft 20 EMP amendment: Impala Platinum Limited (Impala)
2003-2004	Project Manager: EMP amendment for the Maandagshoek Winze Project (re-establishment of an underground shaft): Modikwa Platinum Mine
2002-2005	Project Manager: EIA/EMP amendment for the Opencast Mining Project at the Rustenburg operations: Impala Platinum Limited (Impala)
2002-2003	Project Manager: EMP amendment for The Hills Project (establishment of additional infrastructure for mining purposes): Modikwa Platinum Mine
2002-2003	Project Assistant: EIA and EMP for a greenfields mine – Everest South Platinum Mine: Aquarius Platinum (SA) (Pty) Ltd

2002	Project Assistant: Drilling and bulk sampling EMPs for the Everest South Project: Aquarius Platinum (SA) (Pty) Ltd
2002	Project Assistant: Revised bulk sampling EMP for the Everest South Project: Aquarius Platinum (SA) (Pty) Ltd
2001	Project Manager: EMP amendments for re-positioning of infrastructure for Marikana Platinum Mine: Aquarius Platinum (SA)
RESIDENTIAL, FOOD and BEVERAGE	
2017	Technical E&S Lead: Fatal flaw analysis/site selection screening for a food and beverage developments in Gauteng
2016	Project Manager: Provision of environmental management support to Kumba Iron Ore for the relocation of Dingleton town
2015	Project Reviewer: Basic Environmental process for the Pilanesburg Platinum Mine Housing Development, in the North West Province
2001-2002	Project Assistant: EIA for a village and cemetery for non-landowners to be relocated from the site of Marikana Platinum Mine: Aquarius Platinum (SA) (Pty) Ltd
SILICA AND SAND	
Current	Project Reviewer: EIA/EMP for a mining right application for sand quarry along the Vaal River, in the Free State: Goosebay (Pty) Ltd
2005-2006	Project Manager: EIA/EMP for mining right application at Rietvly Silica Mine: Xstrata South Africa (Pty) Ltd
URANIUM	
2009-2016	Project Manager: ESIA for a greenfields Uranium and Coal Mine in Botswana (Letlhakane Project): A-Cap Resources Limited
ALTERNATIVE ENERGY	
2012	Project Manager: EIA/EMP amendment for the use of alternative fuels at its Lichtenburg Cement Plant: Lafarge Industries SA (Pty) Ltd
2008-On-hold	Project Manager: EIA for cogeneration power plants at Xstrata’s operations in the North West and Mpumalanga Provinces: Power Tech IST/ Xstrata South Africa (Pty) Ltd
INDUSTRY	
2016	Project Reviewer: Basic assessment and Air Emission License for a minerals siding in Bloemfontein: Three clients
BIOREMEDIATION	
2017	Facilitation of DEA bioremediation process for a residential area in the Northern

	Cape
2013-2015	Project Manager: EIA for a waste management license for the bioremediation operation at TransHex Baken Diamond mine in the Northern Cape
CLOSURE PLANNING	
2017	Completion of the environmental and social aspects of the Closure Plan for B2Gold’s mine in Namibia: B2Gold Namibia
OTHER: EXPERT CONSULTANT, DUE DILIGENCE, REVIEWS, RISK ASSESSMENT	
2016-2017	Environmental Specialist: Environmental management services in fulfilment of the environmental legal obligations for the Dingleton Resettlement Project, near Kathu in the Northern Cape
2016	Environmental Specialist: Environmental and Social Due Diligence Review of two wind farm assets located in South Africa
On-going	Environmental Specialist: Environmental input into various pre-feasibility studies linked to the exploration/development/expansion of mining operations.
2015	Environmental Specialist: Legal compliance review of Everest Platinum Mine (Mpumalanga) in support of re-commencing operations
2015 & 2016	Environmental Specialist: Update to Tharisa Mine’s Competent Persons Report
2015	Project Manager: Alfred Knight Lab Due Diligence
2012 and 2013	Environmental Specialist: Due diligence on compliance, water, waste and air related aspects as part of an investment investigation at Silicon Technology (Pty) Ltd
2013	Environmental Specialist: A number of due diligences of gold exploration projects in Tanzania: New African Mining Fund
2012	Environmental Specialist: Input to a legal environmental register for African Barrick Gold’s operations in Tanzania
2012	Environmental Specialist: Peer Review of baseline specialist studies for Gold Fields Damang Gold Mine
2011	Environmental Specialist: Afplats Shaft Risk Assessment Update for Inkosi - Imbasa
2011	Environmental Specialist: Review of Barrick Tulawaka Tailings EIA
2010	Expert Consultant: Environmental input into the ESIA for the expansion of the Morupule Colliery in Botswana: Ecosurv Environmental Consultants
POLICY DRAFTING	
2008	Project Manager: Assistance with drafting a policy, guideline document and procedure for stakeholder participation during explorations operations for the Implats Group: Impala Platinum Limited (Impala)

WATER	
On-going	Project Reviewer: Of a number of water use license applications for mining operations across South Africa
2013	Project Manager: Assistance in compilation of water use license application (WULA) and integrated water and waste management plan (IWWMP) for a new platinum mine and concentrator plant (Mphahlele Project) in the Limpopo Province: Tameng Mining and Exploration (Pty) Ltd
2012	Project Reviewer: Co-ordination of integrated water and waste at Everest Platinum Mine: Aquarius Platinum (South Africa) (Pty) Ltd
2011	Project Manager: Water Supply Study for the Moonlight Iron Ore Project: Turquoise Moon Trading (Pty) Ltd
2011	Project Manager: ESIA for a greenfields wellfield development in Botswana (to supply the Letlhakane Project): A-Cap Resources Limited
2010	Project Reviewer: Re-registration of waste-related water uses at Everest Platinum Mine: Aquarius Platinum (South Africa) (Pty) Ltd
2010	Project Reviewer: Assistance with addressing water use license related issues: Marula Platinum (Pty) Ltd
2010	Project Manager: Water use license application (WULA) for the South Deep Doornpoort tailings dam
2006	Project Manager: Compilation of water use license application (WULA) and integrated water and waste management plan (IWWMP) for South Deep Mine:
Cancelled	Project Reviewer: Basic assessment for a water supply project to the Pilanesberg Platinum Mine Operations: Pilanesberg Platinum Mines (Pty) Ltd
MEMBERSHIPS	
PrSciNat	Registered with the South African Council for Natural Scientific Professions as a Professional Natural Scientist (PrSciNat) in Environmental Science (Reg. No. 400183/05)
EAPAN	Registered with the Environmental Assessment Professionals of Namibia (EAPAN) as a Lead Practitioner (Membership No. 121)
IAIA	Member of the International Association for Impact Assessments (IAIA), South African Affiliate since 2005
PUBLICATIONS	
As part of Masters Dissertation	Onderstepoort Journal of Veterinary Science, 2005. "Aspects of the ecology of the Asian tapeworm <i>Bothriocephalus acheilognathi</i> Yamaguti, 1934 in yellow fish in the Vaal dam, South Africa"

Appendix B: Detailed closure cost calculation

CALCULATION OF THE QUANTUM								
Mine:		Mamatwan Mine						
Evaluators:		SLR Consulting (South Africa) (Pty) Ltd			Date: Life of project as at April 2019			
Risk Class:		Low (Class C)			Escalation (CPI): 121.88%			
Area Sensitivity:		Medium (for Biophysical, Social and Economic Criteria)			Terrain (Weighting factor 1): 1.00 (Flat)			
					Proximity (Weighting factor 2): 1.05 (Peri-Urban)			
No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)
				Step 4.5	Step 4.3	Step 4.3	Step 4.4	
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m ³	N/A	0	R 15.30	1	1	R 0.00
2 (A)	Demolition of steel buildings & structures	m ²	N/A	0	R 210.79	1	1	R 0.00
2 (B)	Demolition of reinforced concrete buildings & structures	m ²	N/A	0	R 310.63	1	1	R 0.00
3	Rehabilitation of access roads	m ²	N/A	0	R 37.72	1	1	R 0.00
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0	R 366.10	1	1	R 0.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0	R 199.69	1	1	R 0.00
5	Demolition of housing &/or administration facilities	m ²	N/A	0	R 421.57	1	1	R 0.00
6	Opencast rehabilitation including final voids & ramps	ha	N/A	0	R 214 577.43	0.52	1	R 0.00
7	Sealing of shafts, adits & inclines	m ³	N/A	0	R 113.16	1	1	R 0.00
8 (A)	Rehabilitation of overburden & spoils	ha	Sinterfontein dump extension	4.00	R 147 327.95	1	1	R 589 311.80
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	Extended stormwater measures (catered for under 8 (A) above)	0.00	R 183 494.30	1	1	R 0.00
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0	R 532 954.44	0.66	1	R 0.00
9	Rehabilitation of subsided areas	ha	N/A	0	R 123 364.97	1	1	R 0.00
10	General surface rehabilitation	ha	Sinterfontein dump extension	4.00	R 116 708.59	1	1	R 466 834.36
11	River diversions (to be decommissioned)	ha	N/A	0	R 116 708.59	1	1	R 0.00
12	Fencing	m	N/A	0	R 133.13	1	1	R 0.00
13	Water management	ha	N/A	0	R 44 375.89	0.25	1	R 0.00
14	2 to 3 years of maintenance & aftercare	ha	All Areas	4.00	R 15 531.56	1	1	R 62 126.24
15 (A)	Specialist study (Screening level risk assessment)	ha	All Areas	1.00	R 195 000.00	1	1	R 195 000.00
							Subtotal 1	R 1 313 272.40
							(Sum of items 1 to 15 Above)	
16	Multiply Subtotal 1 by Weighting Factor 2 (step 4.4)				5.0% of Subtotal 1			R 65 663.62
							Subtotal 2	R 1 378 936.02
							(Subtotal 1 plus Weighting Factor 2 value)	
18	Contingency				10.0% of Subtotal 2			R 137 893.60
18	P&G's				12.0% of Subtotal 2			R 165 472.32
							Subtotal 4	R 1 682 301.94
							(Subtotal 3 plus Contingency value)	
19	VAT				15.0% of Subtotal 4			R 252 345.29
							GRAND TOTAL FOR MINING OPERATIONS	R 1 934 647.24
							(Subtotal 4 plus VAT)	

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