PRELIMINARY MINE CLOSURE PLAN (ADDENDUM)

UMK Manganese Mine

Prepared for: United Manganese of Kalahari (Pty) Ltd

SLR

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REPORT SIGN OFF AND APPROVALS

Stephen Van Niekerk
(Project Manager)

Sharon Meyer
(Reviewer)

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EXECUTIVE SUMMARY

This preliminary mine closure plan has been prepared as an addendum to the current preliminary closure plan for the UMK manganese mine (See *Preliminary Mine Closure Plan* by SLR Consulting, dated October 2017). This addendum only incorporates the proposed changes to the mine layout and operations as identified in the 2021 EMPr Amendment.

This addendum and the original preliminary mine closure plan have both been prepared in accordance with GNR 1147 (Financial Provisioning Regulations, 2015).

The proposed changes to the mine layout and operations include:

- Extended pit footprint (458.5 ha);
- A Block West WRD (145 ha);
- Powerline West Sand Stockpile (35.9 ha);
- Powerline West WRD (196 ha);
- Central West Sand Stockpile (40.9 ha);
- Central West WRD (WRD) (84 ha);
- J Block West WRD (133 ha);
- J Block West Sand Stockpile (46.5 ha);
- J Block East WRD (80.2 ha);
- J Block East Sand Stockpile (16.5 ha);
- truck staging area (20.4 ha);
- truck road (1,280 m);
- TUP Stockpile (12.4 ha);
- stockpile and product loading area extension (53.6 ha);
- modular crusher and stockpile area (54.3 ha);
- 132 KV powerline (3,850 m, 7.7 ha);
- fuel farm (300 m^3 capacity, 0.5 ha);
- workshop, tyre centre and oil storage (10.3 ha);
- permanent salvage yard (2 ha);
- temporary salvage yard (0.4 ha);
- stores yard (0.6 ha);
- hard park area and offices (10.8 ha);
- parking area (0.5 ha);
- bus station extension (0.8 ha);
- product stockpile area (21.4 ha);
- offices (19.1 ha);
- explosives depot (13.1 ha);
- truck staging area extension (1.9 ha); and
- solar equipped boreholes and storage tanks (755 m^3).

It is important to note that none of the proposed changes to the mine layout and operations at UMK Mine have yet been constructed.

The closure cost liability associated with the proposed changes to the mine layout and operations has been undertaken using the DMRE Guideline (which is still considered acceptable for mines with a remaining life greater than 30 years, where an accuracy of at least 50% is appropriate - as defined by GNR 1147 (Financial Provisioning Regulations, 2015)).

The total closure cost liability associated with the proposed changes to the mine layout and operations at UMK Mine as at 31 July 2021 is R 353,443,347 (incl. VAT). The closure liability is at Current Value as at 31 July 2021. A detailed breakdown of the closure cost liability is provided in Table I below.

Table I - Breakdown of closure cost liability for the proposed changes at UMK

Proposed Change	Area	Total closure cost (excl. VAT)	Total closure cost (incl. VAT)
Extended pit footprint	458.5	R 84,932,389	R 97,672,248
A Block West WRD	145.0	R 33,078,957	R 38,040,801
Powerline West Sand Stockpile	35.9	R 6,650,104	R 7,647,620
Powerline West WRD	196.0	R 44,713,625	R 51,420,669
Central West Sand Stockpile	40.9	R 7,576,303	R 8,712,748
Central West WRD	84.0	R 19,162,982	R 22,037,430
J Block West WRD	133.0	R 30,341,389	R 34,892,597
J Block West Sand Stockpile	46.5	R 8,613,645	R 9,905,691
J Block East WRD	80.2	R 18,296,085	R 21,040,498
J Block East Sand Stockpile	16.5	R 3,056,455	R 3,514,923
Truck staging area and north road	20.4	R 4,116,060	R 4,733,468
Truck road (north road)	n/a - incl. above (Truck staging area and north road)		
TUP Stockpile	12.4	R 2,296,972	R 2,641,518
Stockpile and product loading area extension	53.6	R 9,928,846	R 11,418,173
Modular crusher and stockpile area	54.3	R 10,608,281	R 12,199,523
132 KV powerline	7.7	R 314,386	R 361,544
Fuel farm	0.5	R 204,637	R 235,332
Workshop, tyre centre and oil storage	10.3	R 3,394,937	R 3,904,178
Permanent salvage yard	2.0	R 475,659	R 547,007
Temporary salvage yard	0.4	R 121,091	R 139,254
Stores yard	0.6	R 481,569	R 553,804
Hard park area and offices	10.8	R 4,866,180	R 5,596,107
Parking area	0.5	R 150,431	R 172,996
Bus station extension area	0.8	R 207,868	R 239,048
Product stockpile area	21.4	R 3,964,129	R 4,558,748

Offices	19.1	R 6,491,909	R 7,465,696
Explosives depot	13.1	R 2,696,674	R 3,101,175
Truck staging area extension	1.9	R 454,897	R 523,131
Solar equipped boreholes and storage tanks	0.5	R 145,582	R 167,420
TOTALS	**1,466.8**	**R 307,342,041**	**R 353,443,347**

In addition, a further R 7,717,788 (incl. VAT) should be allowed for post-closure monitoring, auditing and reporting over a period of seven years following mine closure.

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EMPr	Environmental Management Programme report
EWT-DCP	Endangered Wildlife Trust – Drylands Conservation Programme
GNR	Government Notice Regulation
IAPs	interested and affected parties
LOM	life of mine
P&G's	Preliminary and general items
SLR	SLR Consulting (Africa) (Pty) Ltd
UMK	United Manganese of Kalahari (Pty) Ltd
WRD	waste rock dump

Preliminary Mine Closure Plan (Addendum)

1. INTRODUCTION

This preliminary mine closure plan has been prepared as an addendum to the current preliminary closure plan (SLR, 2017) for the UMK manganese mine, only incorporating the proposed changes to the mine layout and operations as identified in the 2021 EMPr Amendment.

This addendum and the original preliminary mine closure plan have both been prepared in accordance with GNR 1147 (Financial Provisioning Regulations, 2015).

2. SPECIALIST INPUT

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by United Manganese of Kalahari (Pty) Ltd (UMK) to prepare the preliminary mine closure plan addendum as part of the 2021 EMPr Amendment.

2.1 SPECIALISTS THAT PREPARED THE CLOSURE PLAN

The details of the specialists who prepared this preliminary mine closure plan addendum are provided in Table 2-1 below:

Table 2-1: Details of the Specialists

Details	Project Manager and Author	Reviewer
Name:	Stephen van Niekerk	Sharon Meyer
Tel No.:	011 467 0945	011 467 0945
Fax No.:	011 467 0978	011 467 0978
E-mail address	svanniekerk@slrconsulting.com	smeyer@slrconsulting.com

2.2 EXPERTISE OF THE SPECIALISTS

Stephen van Niekerk is a Technical Director at SLR, holds a MSc Civil Engineering degree, has over 25 years of relevant experience and is registered as a Professional Engineer (#20010256) with the Engineering Council of South Africa (ECSA). Sharon Meyer has an MSc in Environmental Science and Biological Control. Sharon has over 20 years of experience as an environmental scientist and project manager and is registered as an Environmental Assessment Practitioner with EAPASA.

2.3 DECLARATION OF INDEPENDENCE

I, Stephen Van Niekerk and Sharon Meyer 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

The UMK manganese mine is located in the John Taolo Gaetsewe District Municipality in the Northern Cape Province. The mine is situated 13 km south of Hotazel, 42 km north of Kathu and 80 km north west of Kuruman. Current and proposed mining operations in the area include various other manganese open pit mines (such as Mamatwan, Tshipi, Kudumane).

The land capability of the mine area and surrounding area is considered only suitable for grazing and/or wilderness (as per the pre-mining land use).

The mine is an open pit operation that initially commenced in 2008, with all production infrastructure completed in 2012. The mine mainly produces 6mm- 75 mm manganese ore that is transported off-site by rail. There is no processing of ore (other than crushing and screening) and no operational tailings storage facilities. The remaining life of mine (for the open pit operations) is approximately 25 years (up to December 2046).

The proposed changes to the mine layout and operations are presented in Figure 3-1 and Figure 3-2. Further details of the changes are provided in Section 4-2 of this report.

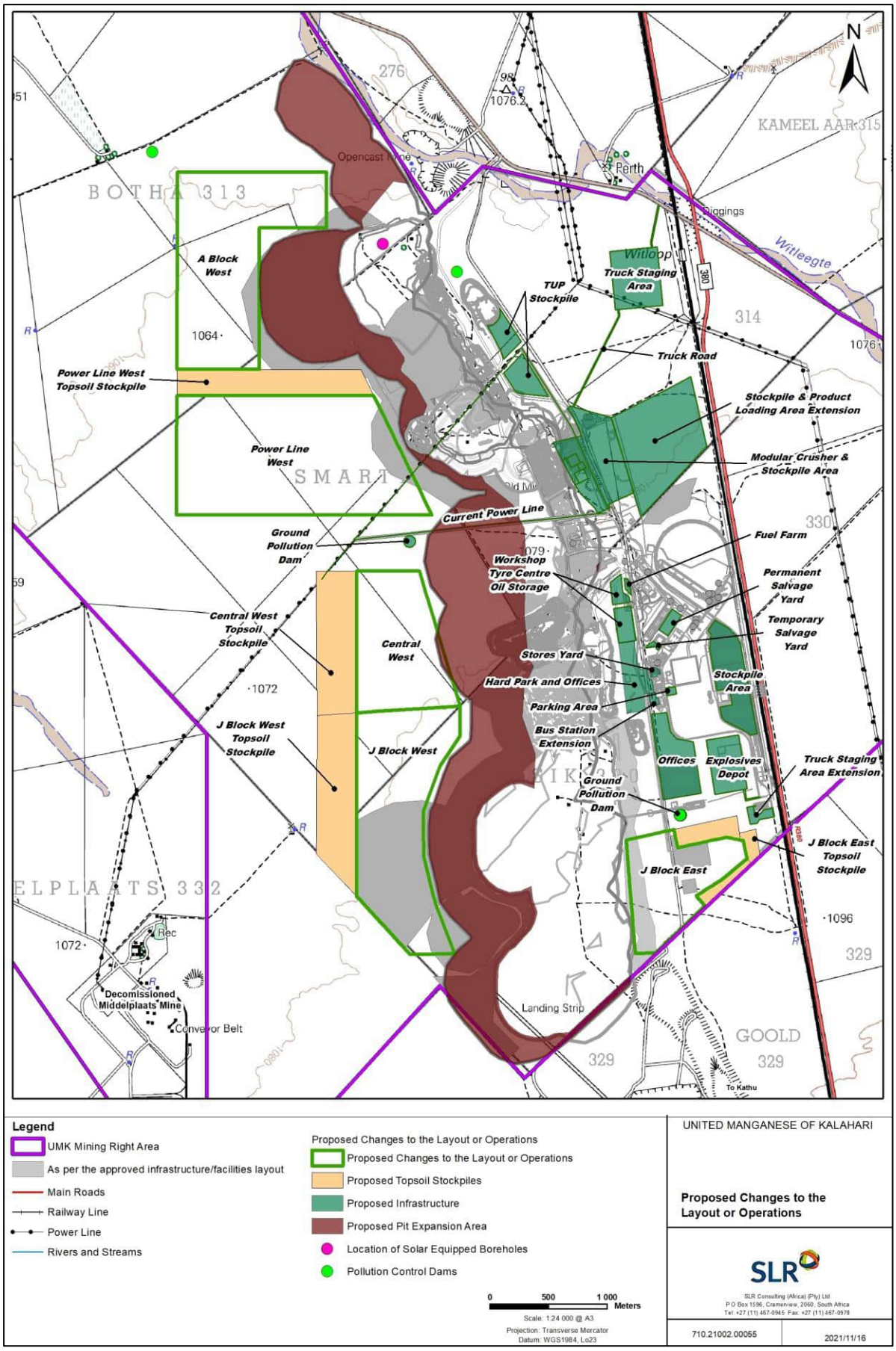

Figure 3-1: Proposed changes to the mine layout and operations at UMK Mine

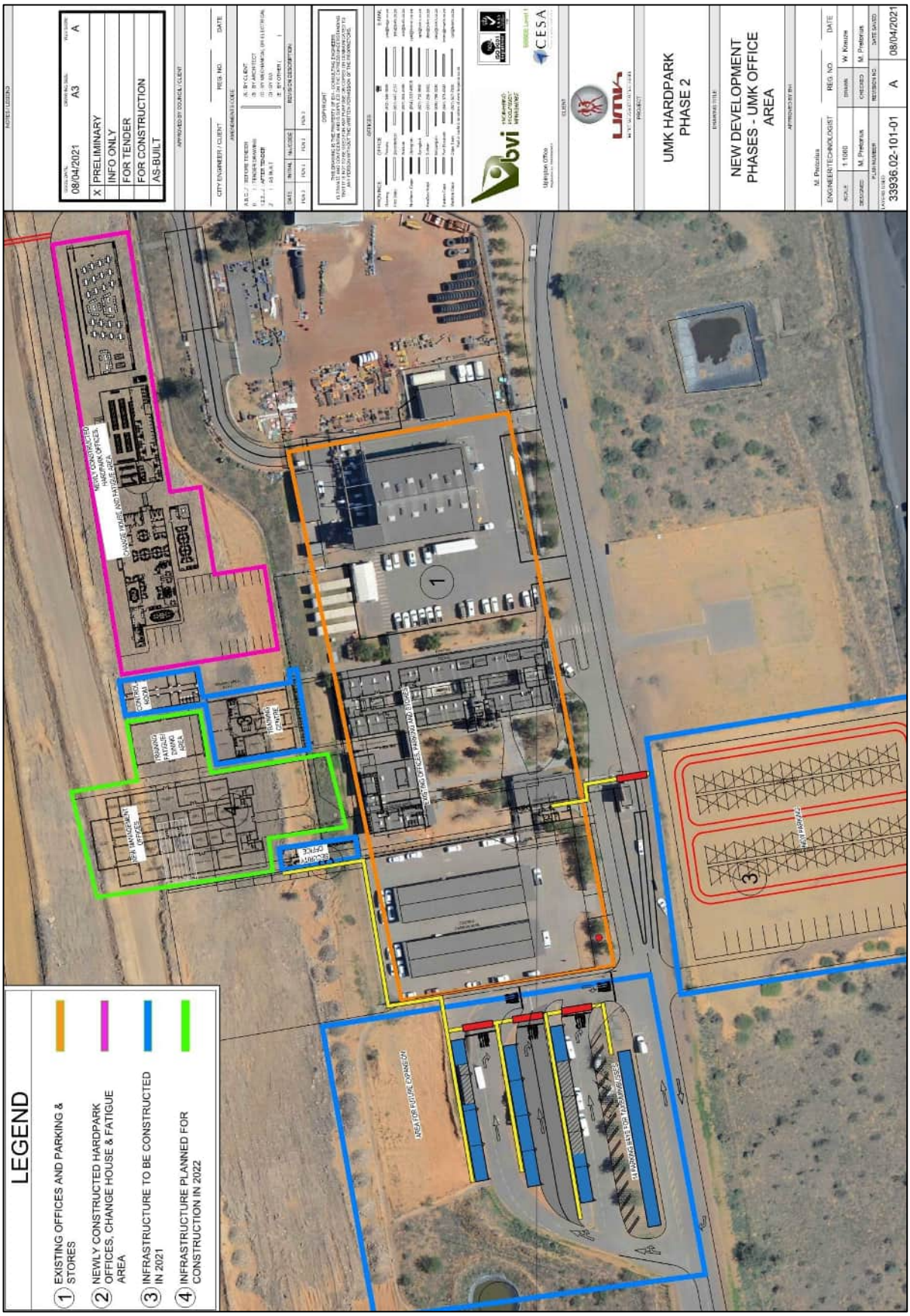

Figure 3-2: Proposed changes at the UMK office area

3.2 ENVIRONMENTAL AND SOCIO-ECONOMIC OVERVIEW

The information in this section provides a summary of the environmental and socio-economic baseline conditions. Information in this section was sourced from the Environmental Impact Assessment Report (EIA) compiled for the Project (SLR, 2021). For further information, refer Section 8.6 of the EIA Report (SLR, 2021).

Table 3-1: Overview of environmental & socio-economic baseline conditions

Aspect	Overview
Topography	The topography of the Kalahari Manganese Field ("KMF") is predominately flat lying at 1100 m elevation, with relatively low relief. The area is characterised by several vegetated northwest and southwest trending red sand dunes, up to 10 m in height, up to 200 m wide and tens of kilometres in length. The regional drainage pattern is broadly northwards but water-flow in the streams is generally very rare. The general elevation of the project area is between 1056 m and 1092 m above mean sea level, and topography is sloping from the southeast and northwest. While the topography has already been altered by infrastructural changes that have taken place, the establishment of additional facilities and activities has the potential to alter the topography and the natural state of undisturbed areas. In the absence of security and access control measures an alteration of the natural topography has the potential to present dangers to both animals and third parties. Changes to the surface infrastructure layout should be such that any changes to topography result in stable topographical features, which do not pose significant risk to third parties and animals and limit impacts on the visual character of the area.
Climate	The project area falls within the Northern Steppe Climatic Zone, as defined by the South African Weather Bureau. This is a semi-arid region characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter. The Mine is characterised by hot summers and cool winters with rain generally occurring in the form of thunderstorms that last for short periods at a time during rainy periods. High evaporation rates reduce infiltration, while rainfall events can increase the erosion potential and the formation of erosion gullies. The regional average daily maximum temperature varies between 27°C and 31°C in January and in July it is approximately 19°C. The regional average daily minimum temperature is about 16°C in January and in July it is roughly 1°C. These climatic aspects need to be taken into consideration during operations, rehabilitation and surface water management planning.
Soils and land capability	The project area consists of three different soil forms, these includes two natural soil forms with undisturbed soil horizon (Ermelo and Hutton) as well as soil that has undergone significant changes as a result of mining activities in the area (Technosols). The Hutton soil form found at the UMK Mine is homogeneous in terms of texture, structure, and soil depth. This soil form is a well-drained sandy soil which allows for high infiltration rates and low organic content.

Aspect	Overview
	These soils are therefore highly erodible. The rapid drainage nature of the Hutton soil form reduces the dry production potential as well as the irrigation potential. The soil fertility is low due to a deficiency in key nutrients such as phosphorus. In general, the soil forms located at the UMK Mine are difficult to work and have a limited utilization potential. Taking the above into consideration soils located at the UMK Mine will require appropriate management measures to prevent the loss of soil resources through pollution and erosion as soil resources form a crucial role during rehabilitation. The land capability at the UMK Mine is classified as having "grazing and wilderness" potential. The land capability at the UMK Mine has been changed due to the presence of approved infrastructure and activities. The establishment of additional surface infrastructure has the potential to influence the land capability of undisturbed areas. Therefore, impact management and rehabilitation planning is required to achieve acceptable post rehabilitation land capabilities
Biodiversity	In general, the project area falls within the Kathu Bushveld, which is characterised by open savannah with Camel Thorn, Vachellia erioloba (formerly known as Acacia erioloba) and Shepherds Tree, Boscia albitrunca as the prominent trees. The shrub layer contains the Grey Camel Thorn, Vachellia haematoxylon (formerly known as Acacia haematoxylon) Black thorn Senegalia mellifera, (formerly known as Acacia mellifera) Blue bush, Diospyros lycioides and Lycium hirsutum. In terms of fauna, the project site hosts both grassland and bushveld bird species. Red data bird species that are likely to occur within the project area include the Martial Eagle, Secretary bird and the Ludwig's Bustard. The loose sandy soils which occurs over a large portion of the study site, makes these areas suitable for burrowing mammals. Species such as, Suricate, Common Mole Rat, and ground squirrels were observed on site. During the site visit a fairly large group of Kudu were observed. The placement of infrastructure as well as mining activities in general have the potential to disturb and/or destroy vegetation, habitat units and related ecosystem functionality including the disturbance of sensitive/ endangered species. The footprint of the waste rock dumps falls within sensitive biodiversity areas which provide habitat for protected tree species. During the design of the infrastructure layout, areas of sensitivity have been taken into consideration and avoided where possible in order to minimise the disturbance and destruction of these areas.
Surface water	The project area is located in the Gamagara catchment of the Orange Basin. The UMK Mine is located in quaternary catchment D41K. The Gamogara and Vlermuisleegte watercourses are situated about 7km to the west and southwest, respectively, of the mine. The Witleegte forms the north-eastern boundary of the UMK mining right area. The Witleegte and Vlermuisleegte both drain in a north westerly direction towards the Gamogara. The Gamogara then flows in a northerly direction and feeds into the Kuruman River approximately 15km downstream of the project site. There is no reliable water use is possible from any of the

Aspect	Overview
	watercourses (Gamogara, Witleegte, Vlermuisleegte) due to the highly seasonal river flow. Infrastructural changes that have already taken place at the UMK Mine present sources of contaminates that present a potential for the pollution of surface water resources. Further to this, natural run-off is collected in all areas that have been designed with water containment infrastructure as required by legislation. It follows that the natural run-off to the catchment has already been influenced by infrastructural changes that have taken place. The continued operation of the UMK Mine and the establishment of additional facilities and activities must be managed/implemented in a way that pollution of water resources is prevented. Moreover, care is required to ensure that surface run-off patterns are disturbed as little as possible to promote the continued flow of water and nutrients
Groundwater	The main regional aquifer is the deep fractured aquifer, consisting of the weathered Dwyka tillite and the Mooidraai Formation dolomite. The Kalahari sand and the sediment beds that overlie the low permeability Dwyka tillite is also considered under certain circumstances as an aquifer. The aquifers are classified as poor to minor aquifers. Borehole yields in the deeper aquifer are low however, structural features such as faults and fractures can produce relatively high yielding boreholes. Typically, there are no influence on the groundwater level by the presence of the non-perennial streams, as groundwater levels do not become shallower with the presence of the stream. The majority of the groundwater in the broader region is used to supply drinking water for cattle and in some instances supply water for domestic use. The nature of mining infrastructure and activities are such that they present potential for pollution of groundwater resources and the lowering of groundwater levels. Baseline groundwater quality results indicate that prior to the establishment of the UMK Mine, groundwater quality had been influenced by anthropogenic pollution from farming and surrounding mining activities. The project must be implemented/ managed in a way that pollution and reduction of groundwater resources is taken into consideration.
Air quality	The current air quality in the area is mostly influenced by mining activities within the UMK Mine, surrounding operations (mines), household fuel combustion, vehicle exhaust emissions and dust entrained by vehicles. These emission sources vary from activities that generate relatively course airborne particulates (such as dust from paved and unpaved roads, and the mine sites) to fine Particulate Matter (PM) such as that emitted by vehicle exhausts, diesel power generators and gas emissions. Air quality within and surrounding the UMK Mine has already been influenced through the presence of approved infrastructure and activities. The establishment of additional facilities and activities presents additional sources of pollutants that may influence existing pollutant concentrations. The activities should therefore be carefully managed to ensure that contributions from the project remain within acceptable limits with associated acceptable impacts.

Aspect	Overview
Noise	Existing sources of noise in the area include mining operations, localised traffic and trains, farming activities and natural sounds. To determine pre-mining noise levels, noise measurements were taken at two potentially sensitive sampling points in the project area, namely at the Perth farmhouse and the Steyn farmhouse, over a 24-hour period. Based on the measured results, ambient noise levels varied from 39dBa during the day (06h00 to 22h00) to 33 dBs at night (22h00 to 06h00) which is typical for a rural area. Mining activities and infrastructure have the potential to cause an increase in ambient noise levels that may cause a disturbance to nearby sensitive receptors during all phases prior to closure. The current ambient noise levels at the UMK mine are related to mining activities at UMK Mine (and neighbouring mines), handling and processing of mineral resources, traffic on mine roads. The establishment of additional surface infrastructure and waste rock dumps will not result in significant changes to the noise emission sources within the UMK mine
Visual aspects	The UMK mine is located within the flat open plains of the Kalahari. The site is rural in nature in that it is sparsely populated with farmhouses scattered throughout the area. The main land use in the area is game and cattle farming. The project site is located within an area known as the manganese belt and as such the sense of place and natural visual character of the area has been altered by the presence of mining operations. The mine is visible to the naked eye from the R380 road between Kathu and Hotazel. The R380 is directly adjacent and to the east of the site. From higher vantage point such as the Kurumanheuwels, the mine may be visible. The mine is to be however visible to people travelling along sections of the main roads (surfaced and gravel) that border the project area. The mine is also visible to residents and workers on adjacent farms and mines. Mining infrastructure has the potential to alter the landscape character of an area through the establishment of infrastructure. It is however important to note, that that the establishment of infrastructure as a result of the proposed surface infrastructural changes will be absorbed by the existing mining infrastructure on site. The establishment of additional surface infrastructure dumps will not result in significant changes to the visual impacts of the UMK mine during construction and operation.
Heritage	The project is located in an arid area characterized by wind-blown aeolian sands and historically very limited human occupation. The immediate project area has been subjected to extensive mining activities in the last two decades. As part of the field survey undertaken, three isolated Stone Age find spots were recorded. These find spots were recorded in areas where calcrete protrudes through the aeolian sand. The possibility exist that Stone Age artefacts could occur below the Aeolian sand similar to observations made by Webley & Halket (2008) in the area. In addition, few formal tools were recorded apart from a possible spoke stave, but some flakes have faceted platforms, and these appear to be of MSA origin. The

Aspect	Overview
	ephemeral occurrences of artefacts at these find spots are isolated, out of context and of no significance. The heritage resources located within the UMK mine are of low heritage significance. Heritage resources are important to the history of South Africa and are protected by national legislation. It follows that in the event on any chance finds, SAHRA needs to be notified and where necessary permits need to be obtained prior to disturbance. This applies to the establishment of additional facilities and activities as part of the project.
Palaeontology	The United Manganese of the Kalahari (UMK) Mine site is on the north-eastern margin of the Griqualand West Sequence of Neoarchean intrusive rocks, in the Prieska Subbasin of the Transvaal Basin that is filled with the sequence of the Transvaal Supergroup. Outcrops of the two main iron and manganese-bearing rocks are exposed to the east of the mine, but below the Kalahari sands are layers of banded iron formation (BIF) that is in primary context in the Kuruman Formation and reworked in the overlying Danielskuil Formation. The project area is covered by aeolian Kalahari sands that were derived from farther to the northwest and finally deposited in this region during the Quaternary. Since they are windblown the sands are not in primary context, nor do they preserve any fossils. Therefore, it is extremely unlikely that there are any pans in the site or any fossils in the sands. There is a low possibility of palaeontological resources occurring at the UMK Mine. Paleontological resources are important to the history of South Africa and are protected by national legislation. It follows that in the event on any chance finds, SAHRA needs to be notified and where necessary permits need to be obtained prior to disturbance. This in particular applies to the establishment of additional facilities and activities as part of the project.
Socio-economic	UMK is located in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province. The nearest community to the mine is the town Hotazel, located approximately 10 km north of the UMK Mine. The Hotazel community has a population of 1 755, this population is low when compared to the local municipality population of 89 531 and the Northern Cape Province population of 1 145 861. This provides an indication of the remoteness of the project area. Majority of the population within the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality are not economically active. There is a large dependency on subsistence agriculture, the public sector, seasonal workers, and employment in the mining sector. In general mining activities have the potential to influence socio-economic conditions both positively and negatively to which the approved mine already contributes. In the context of the approved mine, positive socio-economic influences include contributions in various ways to the local and regional economies. As part of the project care should be taken to avoid influencing negative socio-economic impacts further and allowing for the continuation of the positive socio-economic conditions.

Aspect	Overview
Land use	Land use surrounding the UMK Mine is a mixture of agriculture, community / suburban, mining activities and wilderness. Land use within the project area is limited to mining as a result of the existing mining operations.

3.3 STAKEHOLDER ISSUES AND COMMENTS

Previous issues and concerns (relating to decommissioning and mine closure) raised by interested and affected parties (IAPs) as part of the current preliminary closure plan (SLR, 2017) included:

- long term stability of waste rock dumps;
- post-closure dust prevention;
- post-closure groundwater availability and potential groundwater losses from open pits (if not backfilled);
- prevention of the spread of alien invasive plants;
- time taken to rehabilitate the site (for the resumption of grazing activities);
- effective pollution control; and
- establishing suitable relinquishment criteria to ensure effective rehabilitation of the site.

No new issues and concerns (relating to decommissioning and mine closure) have been raised by IAP's as part of this proposed project.

4. MINE PLAN AND SCHEDULE

Manganese ore is mined from open pits using conventional truck and shovel methods. There are currently four open pit areas, namely: Block D pit, Powerline pit, Tree pit and Block J pit.

4.1 LIFE OF MINE

The remaining life of mine (for open pit mining operations) is approximately 25 years (up to December 2046).

4.2 AREAS OF DISTURBANCE

The current areas of disturbance associated with the UMK manganese mine (and already incorporated in the current preliminary closure plan (SLR, 2017)) include:

- open pit areas (Block D pit, Powerline pit, Tree pit and Block J pit);
- overburden/waste rock dumps (WRDs) and topsoil stockpiles;
- conveyors, related plant and structures;
- crusher plant;
- haul roads and access roads;
- various dirty water dams;
- ROM stockpile area;
- offices, administration area and workshops;
- water treatment plant;
- electrified railway system; and
- Eskom substation.

The proposed changes to the mine layout and operations (to be covered in this addendum to the closure plan) include:

- Extended pit footprint (458.5 ha);
- A Block West WRD (145 ha);
- Powerline West Sand Stockpile (35.9 ha);
- Powerline West WRD (196 ha);
- Central West Sand Stockpile (40.9 ha);
- Central West WRD (WRD) (84 ha);
- J Block West WRD (133 ha);
- J Block West Sand Stockpile (46.5 ha);
- J Block East WRD (80.2 ha);
- J Block East Sand Stockpile (16.5 ha);
- truck staging area (20.4 ha);
- truck road (1,280 m);
- TUP Stockpile (12.4 ha);
- stockpile and product loading area extension (53.6 ha);
- modular crusher and stockpile area (54.3 ha);
- 132 KV powerline (3,850 m, 7.7 ha);
- fuel farm (300 m^3 capacity, 0.5 ha);
- workshop, tyre centre and oil storage (10.3 ha);
- permanent salvage yard (2 ha);
- temporary salvage yard (0.4 ha);
- stores yard (0.6 ha);
- hard park area and offices (10.8 ha);
- parking area (0.5 ha);
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- product stockpile area (21.4 ha);
- offices (19.1 ha);
- explosives depot (13.1 ha);
- truck staging area extension (1.9 ha); and
- solar equipped boreholes and storage tanks (755 m^3).

These proposed changes are shown in Figure 3-1 and Figure 3-2.

5. ENVIRONMENTAL RISK ASSESSMENT

5.1 RISK ASSESSMENT METHODOLGY

An Environmental Impact Assessment has been carried out as part of the EMPr amendment for the UMK manganese mine. Potential environmental impacts were identified by SLR and other stakeholders, and considered in a cumulative manner such that current baseline conditions on site and in the surrounding area were discussed and assessed together.

The assessment methodology used enabled the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

The findings of the EIA indicated that all potential impacts can be prevented or reduced to acceptable levels (i.e. with mitigation measures the potential impacts reduce to Low or Medium ratings).

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

Impacts and risks identified for the project that are likely to extend post-closure are included Table 5-1 below. Strategies to manage and mitigate impacts and risks 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 5-1: Impacts and Risks Identified for the Project

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	**Impact** • Mineral resources can be sterilized and/or lost in the event that UMK disposes feasible mineral resources onto the proposed waste disposal facilities such as waste rock dumps. • Sterilisation of mineral resources can also occur through placement of project infrastructure above the mineable resources. However, the approved EMPr assessed that placement of infrastructure would not sterilise any mineral resources as it may be feasible for these resources to be mined in the future. **Mitigation measures** • Both the approved mine plan and infrastructure layout prevent sterilisation of third-party minerals. This issue will be considered by the mine geologist, environmental manager and mine manager in the pre-feasibility/planning stage of any proposed changes to the mine plan and infrastructure layout.	Medium	Low
Topography	Altering topography	**Impact** • Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. The existing mining related activities have altered the natural topography and in turn creates the potential risk of injury and/or death to both third parties and animals • The proposed project is located within an existing mining footprint and does not present any new infrastructure or activities that differ from those already approved. Further to this, the footprint of the proposed project is within a restricted area with enforced health and safety policies. **Mitigation measures** • Not applicable.	Insignificant	

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
Soil and land capability	Soil Erosion	**Impact** • Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. Soil resources can be lost through physical disturbance such as soil erosion. 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 proposed project will require clearance of an area of approximately 951 ha and is located on several farm portions, the majority of which is located within disturbed areas (existing mining operations) but also on undisturbed areas. • Soil erosion is a measurable deterioration that will occur through vegetation removal from the soil surface. **Mitigation measures** • Limit vegetation clearance to only the areas where the surface infrastructure will be constructed. • Avoid parking of vehicles and equipment outside of designated parking areas. • Plan vegetation clearance activities for dry seasons (late autumn, winter and early spring). • Design and implement a Stormwater Management System where run-off from surfaced areas is expected. • Reduce the slope gradients along haul roads and other disturbed areas to gradients at or below the angle of repose. • Re-establish vegetation along the proposed surface infrastructure to reduce the impact of run-off. • Regularly check all stockpiles and bare surfaces around infrastructure areas, for signs of soil erosion. In the case of any onset of soil erosion being	High	Medium

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		detected, the surfaces must be rehabilitated through the use of geotextiles accompanied by seeding of indigenous vegetation.		
	Disturbance of original soil profiles	**Impact** • The disturbance of original soil profiles and horizon sequences of these profiles during earthworks (stripping of topsoil) is a measurable deterioration. • Once rehabilitation of the pit area has commenced, the rehabilitated soil profiles will be a new soil with properties that may resemble some of the original soil properties but that may also be altered because of the mixing of soil horizons. The "new" soil can still be used for re-vegetation and successful rehabilitation practices will be able to restore the grazing capacity of the land over a period of time **Mitigation measures** • Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint. • Unnecessary land clearance must be avoided. • Level any remaining topsoil that were removed from the railway area and that remained on the surface instead of allowing small stockpiles of soil to remain on the surface.	High	Medium
	Chemical pollution of soils	**Impact** • Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. Soil resources can be lost through contamination. 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.	Medium (Construction) High (Operation)	Very Low (Construction) Very Low (Operation)

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		• The proposed project presents the potential for soil chemical pollution because of potential oil and fuel spillages from vehicles in both operation and construction phases. • The pollution of soils is considered to be a low deterioration of the soil resource **Mitigation measures** • Use drip trays with plastic sheeting filled with absorbent material to contain fuel and lubricants losses from the oil sumps and steering racks of vehicles and equipment. • Use biodegradable hydraulic fluids and lined sumps for collection of hydraulic fluids. • Contaminated soils should be recovered, stored and treated off-site; • Avoiding waste disposal at the site wherever possible through segregating, trucking out, and recycling waste. • Cleaning up areas of spillage of potentially contaminating liquids and solids		
	Soil compaction	**Impact** • Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. Soil resources can be lost through physical disturbance such as soil compaction. 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. • Soil compaction during construction will occur as a result of the heavy vehicles and equipment moving over the soil surface in areas where infrastructure will be constructed. • During the operational phase, vehicles and equipment will move over bare surfaces. **Mitigation measures** • Minimize the areas of activity to that indicated in the infrastructure layout.	High	Medium

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
	Loss of grazing capability	**Impact** • Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. Soil resources can be lost through contamination and through physical disturbance. 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 proposed project will result in loss of grazing capability at the UMK mine. **Mitigation measures** • Minimize the areas of activity to that indicated in the proposed surface infrastructure layout.	High	Medium
Biodiversity	Physical destruction and general disturbance of biodiversity	**Impact** • Areas of ecological sensitivity include functioning biodiversity areas with species diversity 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 a 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. Parts of the project area has been transformed to support the establishment of the UMK mine. • The proposed infrastructural changes can destroy biodiversity through additional loss of natural vegetation, additional loss of protected flora and faunal species of conservation concern and Intentional/accidental killing of fauna. **Mitigation measures** • Implement a comprehensive rehabilitation plan to revegetate the area.	High	Medium

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		• The re-vegetation plan must include the establishment of protected trees within the rehabilitated areas. The progress of tree growth and recruitment must be monitored and actively managed to ensure that the rehabilitated areas reflect the surrounding vegetation in terms of structure and composition. • Where protected trees occur within the planned infrastructure areas, losses can be lessened by re-designing the infrastructure which will minimize the impact to individual trees.		
Surface water	Alteration of natural drainage patterns	**Impact** • There are a number of catchment reduction sources in all project phases that have the potential to impact surface water flows, particularly in the unmitigated scenario. In the construction, decommissioning and closure phases these potential decreases in catchment runoff are temporary in nature. • The operational phase will present more long-term potential catchment runoff loss depending on whether the nature of the modified catchment is clean or dirty. Without considering any mitigation measures or water management measures, the collection of stormwater, physical alteration of drainage lines will reduce catchment runoff flows and flood flows to the watercourses **Mitigation measures** • Implementation of the stormwater management measures.	High	Medium
	Contamination of surface water resources	**Impact** • There are a number of pollution sources in all project phases that have the potential to pollute surface water, particularly in the unmitigated scenario.	High	Very Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		• In the construction, decommissioning and closure phases these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. • The operational phase will present more long-term potential sources. **Mitigation measures** • Implementation of the stormwater management measures.		
Groundwater	Contamination of groundwater resources	**Impact** • Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithological formations. Activities such as the handling and storage of general and hazardous wastes have the potential to result in the loss of groundwater resources, both to the environment and third-party users, through pollution. **Mitigation measures** • Update the hydrocensus to check for any new third-party water uses prior to initiating activities associated with the proposed surface infrastructural changes. • Continue groundwater monitoring per existing monitoring protocols for the existing monitoring network, taking note of recommendation made in the Groundwater Monitoring Report. • All potentially affected boreholes will be included in the water monitoring programme for boreholes located both on and off the mine site. • If any mine related loss of water supply through a reduction in quality is experienced by third party borehole users, UMK will provide compensation which could include an alternative water supply of equivalent water quality. • Should any off-site contamination be detected, the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the	Medium	Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures. • At decommissioning, the potential pollution sources (residual waste rock left on surface) will either be removed or rehabilitated to manage rainfall and seepage. • The environmental manager is responsible for implementing these actions from prior to construction through to closure.		
Air quality	Decrease in ambient air quality	**Impact** • Mining projects present a number of air pollution sources that can have a negative impact on ambient air quality and surrounding land uses in all phases. • Pollution sources include land clearing activities, materials handling, wind erosion from stockpiles, wind erosion of disturbed areas, vehicle movement along unpaved roads, dust generation from crushing and screening plants and gas emissions mainly from vehicles and generators. • From construction and operation perspective, the proposed project could present additional dust generation sources. **Mitigation measures** • Continued implementation of the air quality monitoring programme and dust control measures.	Medium	Low
Noise	Increase in disturbing noise levels	**Impact** • Mining activities and infrastructure have the potential to cause an increase in ambient noise levels that may cause a disturbance to nearby sensitive receptors during all phases prior to closure.	Insignificant	

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		• The current ambient noise levels at the UMK mine are related to mining activities at UMK Mine (and neighbouring mines), handling and processing of mineral resources, traffic on mine roads. • The establishment of additional surface infrastructure and waste rock dumps will not result in significant changes to the noise emission sources within the UMK mine. **Mitigation measures** • Not applicable.		
Visual	Negative visual views	**Impact** • Mining infrastructure has the potential to alter the landscape character of an area through the establishment of infrastructure. • It is however important to note, that the establishment of infrastructure as a result of the proposed surface infrastructural changes will be absorbed by the existing mining infrastructure on site. • The establishment of additional surface infrastructure dumps will not result in significant changes to the visual impacts of the UMK mine during construction and operation. **Mitigation measures** • Not applicable.	Insignificant	
Traffic	Road disturbance and traffic safety	**Impact** • An increase in traffic as well as the use of these roads by heavy vehicles may result in a decrease in road service and safety levels. Traffic impacts are expected from construction through to the end of the decommissioning phase when trucks, buses, and private vehicles make use of the public transport network surrounding the project area. • The key potential traffic related impacts are on road capacity and public safety when additional traffic is added to the existing transport network.	Insignificant	

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
		During the construction, operation, and decommissioning phases of the project there could be a slight increase in traffic from delivery of construction materials, private vehicles making use of the public roads and contractors to the site. • The volumes, frequency and duration of construction and decommissioning traffic is likely to be immaterial as compared to the current baseline and any impact would be negligible. **Mitigation measures** • Not applicable.		
Heritage/ cultural and palaeontological resources	Loss of heritage/ cultural and Palaeontological resources	**Impact** • In general, the proposed project is located in an arid area characterized by wind-blown aeolian sands and historically very limited human occupation. The immediate project area has been subjected to extensive mining activities in the last two decades. • The palaeontological studies conducted indicated that the proposed project is located on the north-eastern margin of the Griqualand West Sequence of Neoarchaean intrusive rocks, in the Prieska Subbasin of the Transvaal Basin that is filled with the sequence of the Transvaal Supergroup. • In the event of a chance find where undisturbed areas will be cleared as part of the establishment of additional facilities and activities there is a potential to damage heritage/ cultural and palaeontological resources (if present), either directly or indirectly, and result in the loss of the resource for future generations. **Mitigation measures** • Implement the chance find procedures. • Excavations through aeolian sands to the calcrete layer especially in the pit should be monitored by an archaeologist or an environmental officer trained by an archaeologist.	Low	Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
Socio-economic	Inward migration	**Impact** • Mines tend to bring with them an expectation of employment in all proposed project phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. • The proposed project is located within an existing mining operation and will result in limited short-term employment opportunities during construction, therefore negative project-related socio-economic impacts including inward migration, which could place additional pressure on housing and municipal services, are not expected to occur **Mitigation measures:** • Not applicable.	Insignificant	
	Economic impact	**Impact** • Mining activities contribute towards a positive economic impact. • The proposed project will allow for the creation of limited short-term employment during the construction phase primarily. • During the operation, decommission and closure phases, the proposed project allows for the continuation of the current employment opportunities which will continue to support UMK's contribution to the positive net economic impact on the national, local, and regional economy • The Proposed project will allow continuation of the current employment opportunities during operation, decommission and closure. **Mitigation measures** • Continued implementation of the existing UMK management actions pertaining to the procurement of local people (where possible) and procurement of local goods.	Low (Positive)	Medium (Positive)

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance	
			Unmitigated	Mitigated
Land use	Change in land use	**Impact** • Mining and project related activities and infrastructure may have an impact on land uses within and surrounding the project area in all phases. • Land use within UMK Mine includes existing mining activities and associated infrastructure. The surrounding land uses includes mining operations, agriculture, isolated farmsteads, infrastructure, and solar plant. • Given that the land use within the proposed project is limited to mining as a result of the existing mining operations, the proposed project will not result in changes to the current land use. **Mitigation measures** • Not applicable.	Insignificant	

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 (i.e. including initial baseline, current and future monitoring results) and compared to the pre-determined rehabilitation success criteria (as presented in Appendix A). 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. All three water courses that drain the mine site are non-perennial, ephemeral 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 pits and remaining waste rock dumps) 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.

Other indicators of rehabilitation success (such as dust fallout, slope stability etc.) have also been included in the overall general rehabilitation monitoring programme as described in Appendix A.

5.4 REASSESSMENT OF RISKS

No changes to the risk assessment are expected. An environmental monitoring programme has been established at the UMK manganese mine to provide early warning systems necessary to avoid environmental emergencies, and for informing continual improvement of the mine closure plan. The monitoring programme includes:

- soil resources;
- groundwater resource quality;
- surface water resource quality;
- air quality; and
- disturbance of biodiversity

Impacts requiring monitoring (including responsibility and frequencies) are detailed in the stand alone EMPr submitted as part of Section 102 EMPr Amendment process.

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 calculation (see Section 13 and Appendix A for specific details). No specific residual or latent environmental impacts have been identified and/or costed at this stage.

Additional remediation activities (i.e. remediation activities not currently anticipated, and if required) will be identified during the ongoing operation of the mine through the various monitoring programmes, environmental audits and/or updated risk assessment and pollution potential studies.

6. CLOSURE DESIGN PRINCIPLES

6.1 LEGAL AND GOVERNANCE FRAMEWORK

The following legislation has been complied with in the drafting of this closure plan addendum:

- Environmental Impact Assessment Regulations, 2014 (GNR 982 of 4 December 2014) that requires a closure plan to contain the information set out in Appendix 5 of these Regulations.
- Mineral and Petroleum Resources Development Amendment Bill, 2013 (Bill 15 of 2013) that require 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.
- Financial Provisioning Regulations, 2015 (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) that require an annual rehabilitation plan, closure plan and environmental risk assessment to contain the information set out in Appendices 3, 4 and 5 of these Regulations.

6.2 VISION, OBJECTIVES AND TARGETS FOR CLOSURE

The vision, objectives and targets for closure have been developed against the local environmental and socio-economic context of the existing mine operation, as well as, regulatory requirements and perceived stakeholder expectations. Stakeholders will continuously be involved in the closure planning process throughout the mine life. The mine 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 mine closure approaches.

6.2.1 Vision for closure

The vision for closure is to create a sustainable post-closure land use which is a combination of natural habitat creation (wilderness) and grazing.

6.2.2 Objectives for closure

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

- to create a functioning ecosystem that supports a sustainable end land use of wilderness and grazing;

- environmental impacts and liability are minimised to the extent that it is acceptable to all parties involved;
- mine closure is achieved efficiently, cost effectively and in compliance with the law; and
- the social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised;

6.2.3 Targets for closure

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

- achieve chemical, physical and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure;
- protect surrounding surface water, groundwater, soils and other natural resources from loss of current utility value or environmental functioning;
- limit the rate of emissions to the atmosphere of particulate matter to the extent that degradation of the surrounding areas' land capability or environmental functioning does not occur;
- 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 OPTIONS

The closure options relevant to this closure plan addendum that have been considered at this stage are presented in Table 6-1 below.

Table 6-1: Alternative Closure Options Considered

Aspect	Options Considered	
Post-closure land-use	A	Agriculture
	B	Wilderness and grazing
Final pit voids	A	Leave open to support alternative use (e.g. underground mining operation or post closure water resource)
	B	Partial backfill of pit voids with overburden to 50 m below surface (to prevent the formation of pit lakes) and rehabilitate area
	C	Complete backfill of pit voids with overburden to natural ground surface and rehabilitate area
Workshop, stores, other mine buildings	A	Leave for small business development (e.g. light engineering, baking, laundry services, paper recycling, taxi operations, timber products etc.)
	B	Demolish and rehabilitate area
Administrative block	A	Leave for small business development (e.g. call centre, centralised office services, teaching and training college etc.)
	B	Demolish and rehabilitate area
Water treatment plant	A	Retain to support small business development
	B	Demolish and rehabilitate area

Main and internal access roads	A	Retain for access and/or to support post-closure land use
	B	Demolish and rehabilitate area
Water holding facilities	A	Retain to support small business development
	B	Demolish and rehabilitate area

☐ Option currently selected

6.4 MOTIVATION FOR PREFERRED CLOSURE OPTION

The bulk of the UMK Mine site (prior to the mining operations) was used for livestock grazing since the area is not suitable for agriculture due to the low clay content of the soils and the low rainfall. The preferred post-closure land use is therefore most likely a combination of wilderness and grazing (provided the field quality is maintained by not exceeding the post-closure grazing capacity).

No alternative closure and post-closure options for mine infrastructure have been considered at this stage (e.g. industrial development, SMME development, housing, recreational facilities etc.). Any alternative and practical closure and post-closure options for mine infrastructure will be further investigated during the ongoing operations of the mine which may necessitate a revision of the closure plan.

The feasibility of alternative closure options will need to be considered in terms of: sustainability of land use, engineering and environmental aspects, monitoring requirements, capital costs, post-closure support services and available institutional capacity and skills.

6.5 MOTIVATION FOR CLOSURE AND POST-CLOSURE PERIOD

A five-year post-closure period for maintenance and aftercare is proposed given that there are no areas of significant potential erosion. This five-year post-closure period has been further sub-divided into three years of active maintenance and two years of passive maintenance (i.e. where maintenance activities have decreased and monitoring frequency declined).

This five-year period for maintenance and aftercare will be verified through concurrent rehabilitation activities and/or field trials during ongoing mine operations.

6.6 ONGOING RESEARCH FOR PROPOSED CLOSURE OPTIONS

Further research regarding the proposed closure options will be ongoing during the remaining life of mine.

The formulation of sustainable post-closure grazing capacities (to maintain field quality) for the various areas of the mine site needs to be further investigated and confirmed, based on the likely revegetation strategy. Field trials will be undertaken during the mining operations to best determine the plant species and methodology for re-establishing a diverse vegetation cover, using the available topsoil and/or growth medium material available. An ecologist and/or rangeland management specialist should be further consulted for this work. Part of this work will also involve identifying suitable neighbouring reference plots to evaluate the success and suitability of the vegetative cover trials (See Section 12.2 and Appendix A for more details).

Additional information and/or research findings could also be sourced from the EWT-DCP project in the Northern Cape's Nama Karoo (launched October 2017). This project aims to identify the drivers and barriers to sustainable land management, including an in-depth assessment of the causes of land degradation and the best available approaches to restore degraded land.

Alternative closure options, as suggested in Section 6.3 (i.e Table 6-1) will also be investigated during the remaining life of mine.

6.7 CLOSURE PLAN ASSUMPTIONS

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

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

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

7. POST-CLOSURE LAND USE

As discussed and elaborated on previously, and in the absence of additional stakeholder input at this stage of the project, the preferred final post-closure land use will be wilderness and grazing.

All of the disturbed areas can be topsoiled and rehabilitated to support the post-closure wilderness and/or grazing land-use including backfilled pit areas and overburden/waste rock dumps (that will both be made safe by shaping and pushing down of steep slopes).

If post-closure grazing capacity is exceeded on any of the disturbed areas (i.e. over-grazing) then the closure objectives to prevent soil erosion, dust, contaminated stormwater runoff, land degradation and slope stability from the mine site may not be met.

7.1 MAP OF POST-CLOSURE LAND USE

A map of post-closure land use indicating the specific areas allocated for wilderness, grazing (and/or other) will be developed during the ongoing operation of the mine.

8. CLOSURE ACTIONS

The preliminary closure actions are as follows:

- surface infrastructure will be demolished and removed;
- the remaining pit voids will be completely backfilled, topsoiled and vegetated;
- the remaining overburden/WRD's will be shaped, topsoiled and vegetated; and
- areas where infrastructure has been removed will be levelled, topsoiled, vegetated and drainage restored (as far as practical).

Generally accepted closure methods have been used as the basis for determining the closure cost liability associated with the proposed changes to the mine layout and operational areas. Further details are provided below

8.1 SPECIFIC TECHNICAL SOLUTIONS

Specific technical solutions related to the disturbed areas associated with the proposed changes to the mine layout and operational areas are detailed below.

8.1.1 Buildings, plant and mine infrastructure

Buildings, processing plant and mine infrastructure (conveyors, water supply pipelines etc.) will all be dismantled, and salvageable elements will be sold and removed from site. Inert non-salvageable elements including concrete, plastic liners, brickwork, conveyor belting etc. will be dismantled or broken up and disposed of into the open pit voids before being covered/buried with waste rock.

Concrete foundations and underground services (e.g. electrical, water and sewer) will all be removed or buried at least 0.5 m below natural ground surface.

Any contaminated soil from the decommissioned areas that cannot be remediated on-site, will be excavated and disposed of offsite at a nearby appropriate facility. (Note: this activity may require notification according to Part 8 of the current NEMWA regulations). Contaminated soils will typically include those contaminated by hydrocarbons (i.e. diesel, oil, grease etc.) and non-biodegradable chemicals (i.e. reagents, chemicals, dust suppressants etc.).

All the decommissioned areas will be landscaped and levelled so that natural stormwater flow is restored and that there is no ponding of water. The decommissioned areas will be covered with 300 mm topsoil /growth medium material (i.e. whatever was initially stripped from the area prior to construction) and revegetated.

8.1.2 Open pit voids

The remaining open pit voids will be backfilled with waste rock to above ground level (to cater for long-term subsidence), covered with topsoil/growth medium material (i.e. whatever was initially stripped from the area prior to construction) and revegetated.

Inert building rubble arising from the demolition of surface infrastructure will be disposed of into the open pit voids before being covered/buried with waste rock.

8.1.3 Overburden/waste rock dumps

Overburden/waste rock dumps remaining post-closure will be shaped to 1V:3H (18°) to create a stable landform. Thereafter the dumps will be covered with topsoil/growth medium material (i.e. whatever was initially stripped from the area prior to construction) and revegetated.

8.1.4 Road network

Gravel roads no longer required for post-closure use will be ripped and covered with stockpiled topsoil to promote the re-establishment of indigenous vegetation. Bituminous roads no longer required for post-closure use will first have the top layer works removed (and carted to a safe disposal facility), and then rehabilitated as per gravel roads.

All concrete lined drainage channels, sumps and culverts associated with closed roads will be broken up and disposed of (buried) in the open pit voids.

8.1.5 Fencing

Fencing no longer required for post-closure use will be removed and recycled for scrap. Inert material such as concrete foundations will be disposed of (buried) in the open pit voids.

8.1.6 Powerlines

Powerlines no longer required for post-closure use will be removed and recycled for scrap. Inert material such as concrete foundations will be disposed of (buried) in the open pit voids.

8.1.7 Stormwater management

The existing stormwater management plan will be updated to identify what stormwater management structures are required post-closure and which can be decommissioned. All the decommissioned areas of the mine site will be levelled and shaped so that the areas are free draining and there is no ponding of water. Any remaining slopes will be modified to at least 1V:3H (or flatter) to minimise erosion, and long slopes may require energy/flow breakers to curb the velocity of stormwater runoff.

It is currently anticipated that none of the pollution control dams will be required post-closure, and hence these facilities and associated infrastructure can be decommissioned (as for concrete foundations, inert liner material etc. as mentioned previously). Any accumulated silt in the pollution control dams (that is typically classified as hazardous) will need to be safely disposed of at a nearby appropriate facility.

The remaining depressions /voids of the pollution control dams may however still prove useful during the maintenance and aftercare phase to act as settling dams and/or silt traps (and can thereafter be filled in and/or shaped to be free draining, and the area revegetated).

8.1.8 Revegetation

Revegetation of disturbed areas will typically be undertaken by:

- replacing the previously stockpiled topsoil and growth medium materials (300 mm layer), and
- planting with indigenous grasses (dry seeding) and deep rooted species such as trees/shrubs (hand planting of seedlings).

Areas requiring revegetation will be shaped and landscaped to ensure that they are free draining (reinstate original drainage lines if practical), steep slopes in excess of 1V:3H are to be avoided (where practical) and all unnecessary remnants (e.g. building rubble) are removed and/or buried.

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 a number of field trials be undertaken during the mining operations to best determine the plant species mix and methodology for re-establishing vegetation (see Section 6.6). 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 – if germinating pods in a nursery is deemed practical). The on-site nursery is not feasible for UMK due to high maintained cost, however, indigenous trees and shrubs will be locally sourced wherever possible. Species procurement will be dependent on availability and the type of species required.

Field trials should be undertaken closer to mine closure and rehabilitation and during any opportunist rehabilitation of disturbed area 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, fertiliser), wet (hydroseeding) or dry seeding techniques, water requirements, maintenance and aftercare requirements, and the time taken to meet the criteria for revegetation success (see Section 12.2).

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 of topsoil);
- 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; and
- establishing key stone (deep rooted) species that assist to promote biodiversity (i.e. shallow rooted species) through hydraulic lift and soil stabilisation.

8.1.9 Maintenance and aftercare

All the rehabilitated areas will require some form of aftercare and maintenance to ensure closure success. These activities will typically include erosion control and filling of erosion gulley'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.

It is currently anticipated that most of the maintenance and aftercare activities will be undertaken in the first three years following closure (the active maintenance period), and thereafter the frequency of activities is expected to stop (in areas where vegetation is considered self-sustaining) and/or decline (passive maintenance period). The passive maintenance period is a further two years of monitoring with a reduced frequency.

8.2 THREATS AND UNCERTAINTIES

The proposed closure land use objective is to create a functioning ecosystem that supports a sustainable end land use of wilderness and grazing. Threats and uncertainties associated with this objective, include:

- the grazing potential is feasible provided the field quality is maintained by not exceeding the grazing capacity. If grazing capacity is exceeded (i.e. over-grazing) then the closure objectives to prevent contaminated stormwater runoff, dust, land degradation etc. may not be met.
- the effects of climate change on the future local environment are unknown and may present a threat for the preferred post-closure land use, as well as, the time taken (i.e. maintenance and aftercare period) to achieve the criteria for revegetation success (see Section 12.2). A five year maintenance and aftercare period has currently been costed in this preliminary closure plan addendum.
- it is currently assumed that all infrastructure will be demolished and removed from site. This assumption should be confirmed with post-closure stakeholders since there may be some post-closure use for certain infrastructure (e.g. offices, workshops, roads, water treatment facilities etc.). See Section 6.3.

9. SCHEDULE OF CLOSURE ACTIONS

The decommissioning and rehabilitation of the proposed changes to the mine layout and operations will be undertaken at the same time as the decommissioning and rehabilitation of the current areas of disturbance at UMK Mine. The decommissioning and rehabilitation of plant, infrastructure and product stockpile areas will take approximately two years to complete.

The footprint areas of the waste rock dumps (cleared and/or with waste rock remnants) can only be rehabilitated once all the waste rock material required for pit backfill has been removed. In the event that the entire waste rock dump material is not required for pit backfill, opportunist rehabilitation will be pursued were practical as per the requirements of the UMK approved Environmental Management Programme. Ongoing field revegetation trials undertaken during mine operations (closer to closure) will indicate the required timeframe for rehabilitation works (as well as the post-closure maintenance and aftercare period for rehabilitated areas).

10. ORGANISATIONAL STRUCTURE AND ROLES

Typical key personnel to ensure compliance to the closure plan and associated commitments are the operations executive and the environmental manager. 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;
- 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 project 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 need to be addressed in the future 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 (plant area, WRD's and pit areas);
- identify and address (on an ongoing basis) any Category 1 alien invasive plant problem areas on site;
- compiling a detailed schedule (and costs) of associated mine closure management supporting services for the mine decommissioning and closure period (e.g. mine manpower, external consultants, ongoing maintenance services, mine security, insurances, municipal rates, equipment licences, IT and communications etc.);
- develop and incorporate socio-economic aspects into the closure plan (community development initiatives and programmes together with end land use objectives for the mining area form an important part of this study);
- investigate what work activities of the closure plan can be undertaken during operations as part of the opportunistic rehabilitation planning;
- closer to mine closure when rehabilitation activities commence UMK should establish a closure plan committee that will meet on a regular basis to inform the closure planning process;
- the on-site nursery is not feasible for UMK due to high maintained cost, however, indigenous trees and shrubs will be locally sources wherever possible. Species procurement will be dependent on availability and the type of species required. Opportunist rehabilitation will be pursued whenever possible. Such rehabilitations will also be part of the field trials that will inform UMK on the types of indigenous trees required for final closure and rehabilitation;
- compile a detailed stormwater management plan at closure for the detailed design and quantification of any stormwater infrastructure;

- identify and calculate the amount of all hazardous materials that will require off-site disposal at a hazardous waste facility;
- obtain site specific (and/or area specific) rates for the scheduled closure activities;
- optimising the pit backfill strategy in terms of sourcing and moving backfill material (i.e. dozing versus load and haul) from the overburden/waste rock dumps; and
- establish post-closure water quality standards and monitoring locations (see Section 4.3 in Appendix A).

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 (with associated performance targets) have been defined which will facilitate evaluation of closure objectives having been met at the UMK Mine. 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. All three water courses that drain the mine site are non-perennial, ephemeral 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 pits and remaining waste rock dumps) 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, 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 of rehabilitation success because it provides a simple, very effective and relevant measure of the rehabilitated lands' capability.

Other indicators of rehabilitation success (such as dust fallout, slope stability etc.) have also been included in the overall general rehabilitation monitoring programme as described in Appendix A.

A summary of the criteria to be utilised for evaluation of rehabilitation success for each of the selected key indicators is provided in the following sections. Details of the decommissioning and rehabilitation monitoring program designed to provide the data necessary to evaluate rehabilitation success, including monitoring methods and frequency, are provided in Appendix A.

12.1 GROUNDWATER QUALITY EVALUATION SYSTEM

To utilise groundwater quality as an indicator of rehabilitation success the UMK Mine will:

- identify sampling locations for rehabilitation, and post-rehabilitation periods;
- determine which water quality analyses are required and the required frequency of sampling;
- establish a detailed field sampling methodology; and
- analyse and compare the results of chemical analyses of groundwater samples to agreed standards (that will be formulated during the development of this closure plan, and ongoing water monitoring carried out during mine operations) to provide proof of compliance, and therefore verification of rehabilitation success, over the agreed monitoring period.

The proposed post-closure groundwater quality monitoring program for the UMK Mine is described in detail in Appendix A, including methods of analysis, monitoring schedule, and definition of rehabilitation success in terms of the monitoring program.

12.2 VEGETATIVE COVER EVALUATION SYSTEM

The degree to which the vegetation cover is effective at reducing erosion is a function of the height and continuity of the plant canopy, the density of the ground contact cover, and the root density. The vegetation contact also dissipates the energy from surface water runoff (and wind), thereby decreasing erosional forces. An increase in the vegetation cover also results in an increase in both the evapo-transpiration rate and the infiltration rate leading to changes in the water balance.

Wildlife diversity (and/or livestock populations) respond positively to an increase in available habitat and food supply that is brought on by the establishment of vegetative cover. Additionally, the success of vegetative cover reflects the chemical and physical suitability of soils to develop and maintain a productive ecosystem that will support a post-closure land use of wilderness and/or grazing (provided the field quality be maintained by not exceeding the post-closure grazing capacity).

Five parameters will be measured to evaluate vegetative cover on rehabilitated land:

- the percentage of basal cover;
- the tree/shrub (woody species) density;
- species diversity and abundance;
- indigenous species composition; and
- the effectiveness of alien and invasive plant control measures.

The percentage of basal cover is the parameter which best represents the overall success of revegetation efforts given all relevant considerations. It is proposed that the line point method be utilised to determine the percentage of basal cover in representative transects of more than 200 points on representative sections of rehabilitated land. This method is utilised worldwide and is advantageous because it is simple and reliable, produces valid results, which are easily interpreted, and does not require any specialised equipment. It also gives species composition and basal cover results in one monitoring section. Tree/shrub density will be evaluated by direct field count in the same representative line transects used for the basal cover assessment. Live, rooted woody stems within one meter either side of the line will be counted and expressed as woody plants per ha as well as species composition.

The vegetative cover monitoring program for the UMK Mine is described in detail in Appendix A.

The on-site nursery is not feasible for UMK due to high maintained cost, however, indigenous trees and shrubs will be locally sources wherever possible. Species procurement will be dependent on availability and the type of species required.

It is proposed that rehabilitation success for vegetative cover is demonstrated when monitoring of vegetative cover in rehabilitated areas at the UMK Mine indicates that:

- the percentage of basal cover on rehabilitated areas is greater than or equal to 90% of the basal cover percentage found on corresponding reference plots with a similar land use (see Section 6.6);
- the density of tree/shrub species (expressed as woody plants per ha) on rehabilitated areas is greater than or equal to 90% of the density of tree/shrub species found on corresponding reference plots with a similar land use;
- the species composition is similar to the species composition of nearby corresponding reference plots; and
- there are no Category 1 alien invasive species occurring on the mine site.

A list of vegetative species that are considered appropriate for use in rehabilitation of the mine property will be confirmed during ongoing field trials at the mine site.

13. MONITORING, AUDITING AND REPORTING

13.1 PRE-CLOSURE MONITORING, AUDITING AND REPORTING

The environmental department manager will conduct internal management audits against the commitments in the EMPr. These audits will be conducted on an on-going basis until final closure. The audit findings will be documented for both record keeping purposes and for informing continual improvement. EMPr performance assessment must be undertaken in accordance to the conditions of the environmental authorisation. The site's compliance with the provisions of the EMPr and the adequacy of the EMPr report relative to the on-site activities will be assessed in the performance assessment.

A monitoring schedule has already been established at the UMK Mine and includes a groundwater and dust monitoring programme. Additional monitoring programmes (e.g. opportunist rehabilitation will be pursued were practical as per the requirements of the UMK approved Environmental Management Programme). Monitoring is the responsibility of the environmental department, and is carried out by the environmental officers, who report to the environmental department manager.

The closure plan, environmental risk assessment and annual rehabilitation plan, once prepared and agreed on, will be audited (and updated) on an ongoing basis throughout the life of the mine in order to inform the annual financial provision required for closure at LOM, as well as, unforeseen premature closure. In accordance with GNR 1147 (Financial Provisioning Regulations, 2015), UMK Mine needs to comply with the financial provisioning regulations by no later than 19 June 2022. The auditing and update of the closure plan, environmental risk assessment and annual rehabilitation plan (following enforcement of GNR 1147) will be carried out by external and independent environmental consultants.

In accordance with GNR 1147 (Financial Provisioning Regulations, 2015), financial provision for closure at LOM, as well as, unforeseen premature closure will be updated on an annual basis. The financial provision will be calculated based on the information contained within the closure plan, environmental risk assessment and annual rehabilitation plan. This update will be carried out by external and independent environmental consultants.
The financial provision amount will also need to be audited by an independent auditor that is registered with the Independent Regulatory Board of Auditors (as from 19 June 2022 in accordance with GNR 1147).

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 closure plan addendum.

13.2 POST-CLOSURE MONITORING, AUDITING AND REPORTING

A preliminary post-closure monitoring and reporting programme has been developed as part of this closure plan addendum. The total estimated cost of the post-closure monitoring and inspection activities has been calculated to be of the order of R 7,717,788 (incl. VAT). A breakdown of the cost is provided in Appendix A. This cost makes provision for quarterly and bi-annual water sampling and site inspections by external and independent environmental consultants over a period of seven years. Provision for a small on-site maintenance team over a period of five years has also been allowed for.

14. CLOSURE COST LIABILITY ESTIMATION PROCEDURE

14.1 CLOSURE COST LIABILITY ASSUMPTIONS AND EXCLUSIONS

The following assumptions and exclusions apply to the closure cost liability estimation procedure in this addendum report:

- the closure cost liability is only for the proposed changes to the mine layout and operations as described in Section 4.2.
- the assumptions made for the development of the preliminary closure plan (see Section 6.7) are relevant to the closure cost liability calculation; and
- the closure cost liability has been calculated as at 31 July 2021 (using the DMRE Guideline (DMRE, 2005)).

14.2 DMRE CLOSURE COST METHODOLOGY

The detailed DMRE closure cost calculations are provided in Appendix B, and summarised below.

In accordance with the DMRE guideline, the UMK Mine has the following classifications:

- Class C Mine – **Low risk** (large manganese mine, greater than 10,000 tonnes per month);
- Environmental sensitivity - **Medium**;
- Nature of the terrain/accessibility – **Flat**; and
- Proximity to urban areas where goods and services are supplied – **Peri-urban** (less than 150 km from a developed urban area).

14.2.1 Quantities

The newly disturbed areas and the bulk of the quantities were calculated from Figure 3-1 (Proposed changes to the mine layout and operations at UMK Mine) and Figure 3-2 (Proposed changes at the UMK office area).

There are currently no detailed infrastructure layouts for a number of areas, namely:

- workshop, tyre centre and oil storage area (10.3 ha);
- stores yard area (0.6 ha);
- hard park area and offices area (10.8 ha);
- bus station extension area (0.8 ha); and
- offices area (19.1 ha).

For these specific areas, the infrastructure layout was estimated based on existing UMK infrastructure elsewhere, as well as, from similar neighbouring manganese mines.

14.2.2 Unit Rates

The unit rates were derived by inflating the prescribed DMRE guideline rates by actual CPI escalation between January 2005 and July 2021 (i.e. roughly 142.63% as per data provided by Statistics South Africa).

14.2.3 P&G's and Contingency Costs

The following P&G's and contingency costs as per the DMRE guideline have also been included:

- P&G's – 12%; and
- Contingency – 10%.

14.3 CLOSURE COSTS LIABILITY CALCULATION

The closure cost liability associated with the proposed changes to the mine layout and operations at UMK Mine as at 31 July 2021 is R 353,443,347 (incl. VAT). The closure liability is at Current Value as at 31 July 2021. A breakdown of the closure cost liability is provided below.

Table 14-1: Breakdown of closure cost liability for the proposed changes at UMK

Proposed Change	Area	Total closure cost (excl. VAT)	Total closure cost (incl. VAT)
Extended pit footprint	458.5	R 84,932,389	R 97,672,248
A Block West WRD	145.0	R 33,078,957	R 38,040,801
Powerline West Sand Stockpile	35.9	R 6,650,104	R 7,647,620
Powerline West WRD	196.0	R 44,713,625	R 51,420,669
Central West Sand Stockpile	40.9	R 7,576,303	R 8,712,748
Central West WRD	84.0	R 19,162,982	R 22,037,430
J Block West WRD	133.0	R 30,341,389	R 34,892,597
J Block West Sand Stockpile	46.5	R 8,613,645	R 9,905,691
J Block East WRD	80.2	R 18,296,085	R 21,040,498
J Block East Sand Stockpile	16.5	R 3,056,455	R 3,514,923

Truck staging area and north road	20.4	R 4,116,060	R 4,733,468
Truck road (north road)	n/a - incl. above (Truck staging area and north road)		
TUP Stockpile	12.4	R 2,296,972	R 2,641,518
Stockpile and product loading area extension	53.6	R 9,928,846	R 11,418,173
Modular crusher and stockpile area	54.3	R 10,608,281	R 12,199,523
132 KV powerline	7.7	R 314,386	R 361,544
Fuel farm	0.5	R 204,637	R 235,332
Workshop, tyre centre and oil storage	10.3	R 3,394,937	R 3,904,178
Permanent salvage yard	2.0	R 475,659	R 547,007
Temporary salvage yard	0.4	R 121,091	R 139,254
Stores yard	0.6	R 481,569	R 553,804
Hard park area and offices	10.8	R 4,866,180	R 5,596,107
Parking area	0.5	R 150,431	R 172,996
Bus station extension area	0.8	R 207,868	R 239,048
Product stockpile area	21.4	R 3,964,129	R 4,558,748
Offices	19.1	R 6,491,909	R 7,465,696
Explosives depot	13.1	R 2,696,674	R 3,101,175
Truck staging area extension	1.9	R 454,897	R 523,131
Solar equipped boreholes and storage tanks	0.5	R 145,582	R 167,420
TOTALS	**1,466.8**	**R 307,342,041**	**R 353,443,347**

It is important to note that none of the proposed changes to the mine layout and operations at UMK Mine have yet been constructed.

In addition, a further R 7,717,788 (incl. VAT) should be allowed for post-closure monitoring, auditing and reporting over a period of seven years following mine closure (See Section 13.2).

The closure cost liability is considered to have an accuracy of at least 50% as a result of using the DMRE Guideline (i.e. acceptable for mines with a remaining life greater than 30 years). Future liability updates will therefore need to focus on improving the closure liability estimates to the required accuracy of at least 70% (i.e. for mines with a remaining life of between 10 and 30 years) by 19 June 2022 – when GNR 1147 (Financial Provisioning Regulations, 2015) becomes applicable for UMK Mine. GNR 1147 requires that the DMRE Guideline for calculating closure liabilities be discontinued, and that independent site-specific contractor rates be applied instead.

15. ANNUAL REHABILITATION PLANNING

Annual rehabilitation plans will be prepared in future updates of the mine closure plan, as part of the requirements of GNR 1147 (Financial Provisioning Regulations, 2015) - that only come into effect on 19 June 2022.

At high level, the objective of annual rehabilitation planning is 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.

At high level, annual rehabilitation and remediation activities associated with the annual rehabilitation plan should take the following into consideration:

- clearing of vegetation in accordance with the relevant vegetation management procedures;
- destructing and disturbing as little vegetation and biodiversity as possible (i.e. limiting the footprint of the mines operations), and retaining as much natural vegetation as possible;
- stripping and stockpiling of soil resources in areas designated for surface infrastructure in line with the soil conservation procedure;
- backfilling of mined out pit areas in accordance with the mine plan;
- opportunistic rehabilitation of overburden dumps (no longer required) that are expected to remain post-closure, where practical;
- general, hazardous and medical waste collection, storage and disposal; and
- ongoing monitoring of groundwater, surface water and air quality.

16. RECOMMENDATIONS

This closure plan addendum for the UMK Mine, and hence the overall level of confidence in the closure cost liability can be improved by:

- ongoing research related to the proposed closure options (Section 6.6), such as:
    - sustainable post-closure grazing capacities (to maintain field quality) for the various areas of the mine site need to be further investigated and confirmed based on the likely revegetation strategy.
    - The on-site nursery is not feasible for UMK due to high maintained cost, however, indigenous trees and shrubs will be locally sources wherever possible. Species procurement will be dependent on availability and the type of species required. Opportunist rehabilitation will be pursued whenever possible. Such rehabilitations will also be part of the field trials that will inform UMK on the types of indigenous trees required for final closure/rehabilitations.

  - undertaking and monitoring of trial revegetation programmes prior to closure and rehabilitation to evaluate and determine the most effective plant species mix and methodology for re-establishing a diverse vegetation cover, using the available topsoil and/or growth medium material available.
- exploring threats and uncertainties associated with the proposed closure option (see Section 8.2), such as:
  - predicting the possible effects of climate change on the post-closure land use of wilderness and/or grazing, as well as, the current proposed five year maintenance and aftercare period in order to achieve the criteria for revegetation success; and
  - confirming the assumption that all infrastructure will be demolished and removed from site. Certain infrastructure (e.g. offices, workshops, roads, water treatment facilities etc.) may have a beneficial use post-closure.
- addressing the currently identified gaps (see Section 11), namely:
  - 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 (plant area, WRD's and pit areas);
  - identify and address (on an ongoing basis) any Category 1 alien invasive plant problem areas on site;
  - compiling a detailed schedule (and costs) of associated mine closure management supporting services for the mine decommissioning and closure period (e.g. mine manpower, external consultants, ongoing maintenance services, mine security, insurances, municipal rates, equipment licences, IT and communications etc.);
  - develop and incorporate socio-economic aspects into the closure plan (community development initiatives and programmes together with end land use objectives for the mining area form an important part of this study);
  - opportunist rehabilitation will be pursued on site were practical as per the requirements of the UMK approved Environmental Management Programme (EMPr);
  - establish a closure plan committee that will meet on a regular basis to inform the closure planning process;
  - the on-site nursery is not feasible for UMK due to high maintained cost, however, indigenous trees and shrubs will be locally sources wherever possible. Species procurement will be dependent on availability and the type of species required opportunist rehabilitation will be pursued on site were practical as per the requirements of the UMK approved Environmental Management Programme (EMPr).
  - .;
  - compile a detailed stormwater management plan at closure for the detailed design and quantification of any stormwater infrastructure;
  - identify and calculate the amount of all hazardous materials that will require off-site disposal at a hazardous waste facility;
  - optimising the pit backfill strategy in terms of sourcing and moving backfill material (i.e. dozing versus load and haul) from the overburden/waste rock dumps; and
  - establish post-closure water quality standards and monitoring locations (see Section 4.3 in Appendix A).

In order to fully comply with GNR 1147 (Financial Provisioning Regulations, 2015) which is currently anticipated to be effective from 19 June 2022, the following will need to be undertaken:

- development of an annual rehabilitation plan (see Section 15);
- generation of a post-closure land use map (see Section 7.1); and
- obtain site specific rates for the scheduled closure activities (i.e. DMRE Guideline rates will no longer be accepted). See Section 14.3.

17. CONCLUSION

This addendum to the current preliminary closure plan (SLR, 2017) for the UMK manganese mine has been generated for the proposed changes to the mine layout and operations as identified in the 2021 EMPr Amendment.

18. REFERENCES

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

Financial Provisioning Regulations, 2015. *Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations*. November 2015. Ref: GNR 1147 of the National Environmental Management Act (107/1998).

SLR, 2017. *Preliminary Mine Closure Plan*. SLR Consulting. October 2017. Ref: 710.21002.00035.

SLR, 2021. *EIA for Surface Infrastructure Changes at the UMK Mine*. September 2021. Ref: 710.21002. 00055.

APPENDIX A: COSTED REHABILITATION EVALUATION CRITERIA

1. INTRODUCTION

This Appendix presents a description of criteria to be utilised in the evaluation of rehabilitation success on rehabilitated areas and a suggested monitoring programme to be implemented for this evaluation. The monitoring programme is designed to measure the success of decommissioning and rehabilitation measures in terms of the rehabilitation success indicators defined in the preliminary closure plan (SLR, 2017).

The monitoring programme will include evaluation of:

- vegetative success on rehabilitated areas in terms of vegetative cover, tree/shrub (woody species) density, and indigenous species composition; and
- groundwater quality surrounding and/or down gradient of the rehabilitated areas.

Other indicators of rehabilitation success (such as dust fallout, slope stability, etc.) have also been included in the overall general rehabilitation monitoring programme as described below.

2. GENERAL REHABILITATION MONITORING

In addition to the specific monitoring activities described in Sections 3 and 4 of this Appendix report, the post-rehabilitation monitoring programme will include regular general inspections of rehabilitated areas to assess their condition and to determine any maintenance requirements. These inspections will include:

- slope stability of the remaining WRD's;
- dust fallout monitoring (around the remaining WRD's) – if required, and largely dependent on the progress of the proposed vegetative cover systems;
- stormwater and erosion control features including drainage channels and diversions;
- soil erosion, soil conditions (nutrients, trace constituents) and soil structure;
- faunal habitation of rehabilitated areas;
- biological productivity;
- protected access, fences and signs erected for public safety;
- site security; and
- unusual conditions in any rehabilitated area.

Climatic data (minimum/maximum temperatures and rainfall) will also be recorded and kept for correlation to field observations.

General inspections of all rehabilitated areas will be completed at a minimum of quarterly intervals for the aspects defined. Records of all the monitoring and maintenance activities undertaken will be kept. If the general site condition monitoring activities reveal the requirement for any maintenance or repair of rehabilitated areas, then the necessary works will proceed in a timely fashion to minimise the potential for damage to rehabilitated areas such as soil loss, plant loss and drainage channel disturbance.

Should a condition be identified in any rehabilitated area which has the potential to cause serious environmental damage, or which threatens the health and safety of post-closure land users, then the relevant Authorities (DMRE, DWS) will be immediately notified of this condition and the remedial measures being undertaken to reduce the potential for harm.

3. VEGETATIVE COVER MONITORING

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 degree to which the vegetation cover is effective in reducing erosion is a function of the height and continuity of the plant canopy, the density of the ground cover, and the root density.

The vegetation cover also dissipates the energy from surface water runoff (and wind), thereby decreasing erosion forces. An increase in the vegetation cover results in an increase in both the evapo-transpiration rate and the infiltration rate leading to changes in the water balance. Finally, wildlife diversity and populations respond positively to an increase in available habitat and food supply that is brought on by the establishment of vegetative cover.

The major potential concerns with vegetative cover on rehabilitated areas are related to the adequacy of ground contact cover, the overall density of tree/shrub (woody) species, indigenous species composition and the presence 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.

3.1 BASAL COVER ANALYSIS

3.1.1 Basal Cover Percentage Analysis

The adequacy of vegetative ground contact cover in providing effective erosion control, habitat establishment and soil building for post-closure land uses is related to the percentage basal cover of the site and species composition. Basal cover is a measurement of the contact cover of live rooted vegetation expressed as a percentage of the number of points assessed.

A minimum of 200 points per transect is normally required for reliable results and one of the most effective methods of measurement is using the line-point method. This method also allows for measuring species composition and woody plant density at the same time.

Basal cover very seldom exceeds 25% and is correlated to rainfall and species composition. High rainfall can sustain a higher density of plants leading to higher basal cover. Plants with a creeping growth form dominating a site, also tends to lead to higher basal cover.

No biomass assessments will be done.

3.1.2 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 measuring basal cover percentage will be utilised for determining woody species density. A count of all rooted, live woody plant within one meter on either side of the line will be done.

No biomass assessments will be done.

3.1.3 Species Composition Analysis

The composition of species occurring will be measured by noting species names of the live rooted plant closest to each point in the basal cover assessment. Each species will be listed as to its desirability in the specific veld type. Alien invasive species will be listed wherever they occur on site, and not just in the assessment transects.

The percentage presence of each species will be depicted after each year's monitoring and trends tracked to see if the climax species starts to dominate in the area.

A representative presence of climax species on the rehabilitated site, similar to that found in reference sites of the same veld type will indicate rehabilitation success.

3.1.4 Historic Record 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 in the same veld type) will be marked in areas near rehabilitated sites for determining the degree of achievement of rehabilitation success. This procedure, known as historic record sampling, provides an indication of the cover and diversity found in undisturbed areas.

Vegetative cover and diversity on reference plots will be compared with that on rehabilitated areas. These reference areas will be at least 2500 m² in size. Cover and diversity assessments will be done on reference sites at the same time of assessing the rehabilitated sites and will be compared to the results obtained from the rehabilitated sites.

3.2 VEGETATIVE COVER 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.

3.3 REHABILITATION SUCCESS CRITERIA FOR VEGETATIVE COVER INDICATORS

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 90% of the basal cover percentage found on corresponding reference plots with a similar land use;
- the density of tree/shrub species (woody species) on rehabilitated areas is greater than or equal to 90% of the density of tree/shrub species found on corresponding reference plots with a similar land use;
- the species composition is similar to the species composition of nearby corresponding reference plots; and
- there are no category 1 declared weeds occurring on the site.

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.

4. GROUNDWATER QUALITY MONITORING

The groundwater quality monitoring programme is designed to verify that groundwater quality down gradient of potential sources of pollution such as the WRD's and pits complies with agreed standards.

The major potential concerns with post-closure groundwater quality down gradient of potential sources of pollution are related to pH, salts, and metals. The groundwater quality monitoring programme has therefore been designed to evaluate these parameters where appropriate to ensure long-term environmental protection and the suitability of groundwater for post-closure land uses.

4.1 GROUNDWATER QUALITY ANALYSIS

Groundwater monitoring should occur at those locations where there are surface activities or infrastructure which has the potential of pollution.

The physical and chemical parameters to be included in laboratory analyses of groundwater samples has been selected based upon site criteria/characteristics and geochemical results to date. A list of recommended parameters is given in Table A-1. This may expand (or reduce) following further geochemical analysis and collection of data.

Table A- 1: Recommended Groundwater Quality Analysis Parameters

Recommended Groundwater Quality Analysis Parameters		
pH	Carbonate as CO_3	Nitrate as N
Electrical conductivity	Bicarbonate as HCO_3	Magnesium
Fluoride as F	Total dissolved solids	Manganese
Total alkalinity as $CaCO_3$	Sodium	Calcium
Chloride as Cl	Sulphate as SO_4	Potassium
33 metals (ICP-OES scan)		

4.2 GROUNDWATER QUALITY MONITORING SCHEDULE

The locations (and frequency) of groundwater quality monitoring during decommissioning, rehabilitation and aftercare periods will be based on the groundwater monitoring locations (and frequency) at LOM with additional sampling points added as necessary to ensure all potentially affected groundwater are monitored.

Groundwater quality samples will be collected by suitably qualified staff following standard international protocol for collection of environmental samples. Groundwater monitoring results will be recorded and included in ongoing monitoring reports.

Should statistical analysis of groundwater monitoring results for the three year (active maintenance and aftercare) period following completion of decommissioning and rehabilitation activities indicate that agreed standards for protection of groundwater quality will not be met for a particular area, then a study will be commissioned to determine the causes of such failure, the potential for harm to the environment and/or post-closure land users, the need for remedial measures, and to recommend practicable remedial measures if required.

In such a case, if the indicated groundwater quality emanating from rehabilitated areas is representative of baseline/background (or up gradient) groundwater quality on the rehabilitated areas and in the surrounding region, then previously agreed standards may need to be modified (in agreement with the regulatory Authorities, DWS and DMRE).

4.3 REHABILITATION SUCCESS CRITERIA FOR GROUNDWATER QUALITY INDICATORS

Rehabilitation success for the groundwater quality indicators will be demonstrated when statistical analysis (and trends) of source term monitoring results for the three year (active maintenance and aftercare) period following the completion of decommissioning and rehabilitation activities indicate that agreed water quality standards for groundwater will not be exceeded at monitored locations. Achievement of the rehabilitation success criteria for groundwater quality will ensure that groundwater on (and immediately down gradient of) the rehabilitated areas are suitable for post-closure land users.

The agreed water quality standards still need to be formulated during the development of this closure plan, and through ongoing water monitoring carried out during mine operations. The agreed standards also need to take into consideration the baseline water quality, as well as, any potential upstream impacts.

Post-closure monitoring locations will also need to be defined (from already existing water monitoring locations).

5. MONITORING AND INSPECTION COSTS

Unit rates for monitoring, analyses and inspection activities were developed based on the costs of similar activities being undertaken by SLR. The total estimated cost of the monitoring and inspection activities associated with the proposed changes to the mine layout and operations is R 6,711,120 (excl. VAT) or R 7,717,788 (incl. VAT). A breakdown of the cost is presented in Table A-2.

Provision has been made for additional groundwater sampling and reporting at the following frequencies during the seven years of decommissioning, rehabilitation, monitoring and maintenance activities:

- Quarterly during decommissioning and rehabilitation (two years),
- Quarterly during active maintenance and aftercare (three years), and
- Bi-annually during passive maintenance and aftercare (two years).

The cost for additional groundwater sampling and reporting over the seven year period is R 2,569,200 (excl. VAT) or R 2,954,580 (incl. VAT).

Provision has also been made for additional bi-annual inspection time and reporting work by an environmental scientist. There will be 14 inspections over the seven year period. The total provision is R 899,220 (excl. VAT) or R 1,034,103 (incl. VAT).

The cost of additional personnel required for the on-site maintenance and monitoring activities have also been included at R 648,500 per annum (excl. VAT). Allowance has been made for five years (i.e. three years – active maintenance and aftercare, two years – passive maintenance and aftercare). It is assumed that this work will be mostly contracted out and provision has been made for a manager (part-time), a field supervisor (full-time) and 5 labourer's (full time). The total provision for the five year period is R 3,242,700 (excl. VAT) or R 3,729,105 (incl. VAT).

Table A- 2: Summary of Supervision and Monitoring Costs

Item	Monitoring / Maintenance Activity	no. / year	Cost/activity	Duration (years)	Frequency	Unit	Quantity	Total Cost
1	**WATER QUALITY**							
1.1	*Collection and Laboratory Analysis of Ground Water Samples*							
1.1.1	Decommissioning and Rehabilitation Phase	4	R 107 050	2	quarterly	Sum	8	R 856 400
1.1.2	Maintenance and Aftercare - Active Phase	4	R 107 050	3	quarterly	Sum	12	R 1 284 600
1.1.3	Maintenance and Aftercare - Passive Phase	2	R 107 050	2	bi-annual	Sum	4	R 428 200
2	**BI-ANNUAL INSPECTIONS**							
2.1	*Inspection of Decommissioning and reclamation works by a local suitably qualified and experienced Environmental Scientist*							
2.1.1	Decommissioning and Rehabilitation Phase	2	R 64 230	2	bi-annual	Sum	4	R 256 920
2.1.2	Maintenance and Aftercare - Active Phase	2	R 64 230	3	bi-annual	Sum	6	R 385 380
2.1.3	Maintenance and Aftercare - Passive Phase	2	R 64 230	2	bi-annual	Sum	4	R 256 920
3	**MANAGEMENT OF MONITORING AND MAINTENANCE**							
3.1	*On-Site Maintenance, Monitoring and Aftercare of the Decommissioning and Reclamation Process by an appropriately qualified and experienced team.*					Years	5	R 3 242 700
		Days/month	**Rate / day**	**Total/month**	**Total/year**			
	- 1 Manager	*1*	*R 12 045*	*R 12 045*	R 144 540			
	- 1 Field Supervisor	*20*	*R 600*	*R 12 000*	R 144 000			
	- 5 Labourers	*100*	*R 300*	*R 30 000*	R 360 000			
					R 648 540			
							TOTAL (excl. VAT)	**R 6 711 120**

APPENDIX B: CLOSURE COST LIABILITY CALCULATIONS FOR THE PROPOSED CHANGES TO THE MINE LAYOUT AND OPERATIONS

CALCULATION OF THE QUANTUM								
Area	***United Manganese of Kalahari (Pty) Ltd***					Period	***Proposed Layout Changes (CV - July 2021)***	
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	132 KV powerline	2 925	R 16.55	1	1	R 48 408.75
2 (A)	Demolition of steel buildings & structures	m^2	Fuel farm tanks	200	R 230.50	1	1	R 46 100.00
		m^2	Workshop, tyre centre and oil storage	4 225	R 230.50	1	1	R 973 862.50
		m^2	Stores yard building	1 060	R 230.50	1	1	R 244 330.00
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	132 KV powerline - foundations	195	R 339.68	1	1	R 66 237.60
3	Rehabilitation of access roads	m^2	n/a	0	R 41.25	1	1	R 0.00
4 (A)	Demolition & rehabilitation of electrified railway lines	m	n/a	0	R 400.33	1	1	R 0.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	n/a	0	R 218.36	1	1	R 0.00
5	Demolition of housing &/or administration facilities	m^2	Hard park & Offices - Security Office	80	R 460.99	1	1	R 36 879.20
		m^2	Hard park & Offices - Manag. Offices	1 400	R 460.99	1	1	R 645 386.00
		m^2	Hard park & Offices - Dining Area	286	R 460.99	1	1	R 131 843.14
		m^2	Hard park & Offices - Training Centre	513	R 460.99	1	1	R 236 487.87
		m^2	Hard park & Offices - Control Room	250	R 460.99	1	1	R 115 247.50
		m^2	Hard park & Offices - Change Houses	1 278	R 460.99	1	1	R 589 145.22
		m^2	Hard park & Offices - Fatigue Room	630	R 460.99	1	1	R 290 423.70
		m^2	Offices area - Various Facilities	4 450	R 460.99	1	1	R 2 051 405.50
6	Opencast rehabilitation including final voids & ramps	ha	n/a	0	R 234 620.03	0.52	1	R 0.00
7	Sealing of shafts, adits & inclines	m^3	n/a	0	R 123.74	1	1	R 0.00

8 (A)	Rehabilitation of overburden & spoils	ha	A Block West WRD	145.0	R 161 104.14	1	1	R 23 360 100.30
		ha	Powerline West WRD	196.0	R 161 104.14	1	1	R 31 576 411.44
		ha	Central West WRD	84.0	R 161 104.14	1	1	R 13 532 747.76
		ha	J Block West WRD	133.0	R 161 104.14	1	1	R 21 426 850.62
		ha	J Block East WRD	80.2	R 161 104.14	1	1	R 12 920 552.03
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	Pollution dams	0.4	R 200 652.29	1	1	R 80 260.92
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	n/a	0	R 582 789.37	0.66	1	R 0.00
9	Rehabilitation of subsided areas	ha	n/a	0	R 134 900.45	1	1	R 0.00
10	General surface rehabilitation, including grassing of all denuded areas	ha	Extended Pit Footprint	459	R 127 621.65	1	1	R 58 514 526.53
		ha	Powerline West Sand Stockpile	35.9	R 127 621.65	1	1	R 4 581 617.24
		ha	Central West Sand Stockpile	40.9	R 127 621.65	1	1	R 5 219 725.49
		ha	J Block West Sand Stockpile	46.5	R 127 621.65	1	1	R 5 934 406.73
		ha	J Block East Sand Stockpile	16.5	R 127 621.65	1	1	R 2 105 757.23
		ha	Truck staging area and north road	20.4	R 127 621.65	1	1	R 2 603 481.66
		ha	TUP Stockpile	12.4	R 127 621.65	1	1	R 1 582 508.46
		ha	Stockpile and product loading area extension	53.6	R 127 621.65	1	1	R 6 840 520.44
		ha	Modular crusher and stockpile area	54.3	R 127 621.65	1	1	R 6 929 855.60
		ha	Fuel farm	0.5	R 127 621.65	1	1	R 63 810.83
		ha	Workshop, tyre centre and oil storage	10.3	R 127 621.65	1	1	R 1 314 503.00
		ha	Permanent salvage yard	2.0	R 127 621.65	1	1	R 255 243.30
		ha	Temporary salvage yard	0.4	R 127 621.65	1	1	R 51 048.66
		ha	Stores yard	0.6	R 127 621.65	1	1	R 76 572.99
		ha	Hard park area and offices	10.8	R 127 621.65	1	1	R 1 378 313.82
		ha	Parking area	0.5	R 127 621.65	1	1	R 63 810.83
		ha	Bus station extension area	0.8	R 127 621.65	1	1	R 102 097.32
		ha	Product stockpile area	21.4	R 127 621.65	1	1	R 2 731 103.31
		ha	Offices area	19.1	R 127 621.65	1	1	R 2 437 573.52
		ha	Explosives depot	13.1	R 127 621.65	1	1	R 1 671 843.62
		ha	Truck staging area extension	1.9	R 127 621.65	1	1	R 242 481.14
		ha	Solar equipped boreholes and storage tanks	0.5	R 127 621.65	1	1	R 63 810.83

11	River diversions (to be decommissioned)	ha	n/a	0	R 127 621.65	1	1	R 0.00
12	Fencing	m	Truck staging area and north road	1 808	R 145.58	1	1	R 263 208.64
		m	Modular crusher and stockpile area	2 948	R 145.58	1	1	R 429 169.84
		m	Fuel farm	284	R 145.58	1	1	R 41 344.72
		m	Workshop, tyre centre and oil storage	1 284	R 145.58	1	1	R 186 924.72
		m	Permanent salvage yard	564	R 145.58	1	1	R 82 107.12
		m	Temporary salvage yard	252	R 145.58	1	1	R 36 686.16
		m	Stores yard	308	R 145.58	1	1	R 44 838.64
		m	Hard park area and offices	1 316	R 145.58	1	1	R 191 583.28
		m	Parking area	310	R 145.58	1	1	R 45 129.80
		m	Bus station extension area	320	R 145.58	1	1	R 46 585.60
		m	Offices area	1 748	R 145.58	1	1	R 254 473.84
		m	Explosives depot	1 448	R 145.58	1	1	R 210 799.84
		m	Truck staging area extension	552	R 145.58	1	1	R 80 360.16
		m	Pollution dams	252	R 145.58	1	1	R 36 686.16
		m	Solar equipped boreholes and storage tanks	284	R 145.58	1	1	R 41 344.72
13	Water management	ha	n/a	0	R 48 525.34	0.25	1	R 0.00
14	2 to 3 years of maintenance & aftercare	ha	Extended Pit Footprint	458.5	R 16 983.87	1	1	R 7 787 104.40
		ha	A Block West WRD	145.0	R 16 983.87	1	1	R 2 462 661.15
		ha	Powerline West Sand Stockpile	35.9	R 16 983.87	1	1	R 609 720.93
		ha	Powerline West WRD	196.0	R 16 983.87	1	1	R 3 328 838.52
		ha	Central West Sand Stockpile	40.9	R 16 983.87	1	1	R 694 640.28
		ha	Central West WRD	84.0	R 16 983.87	1	1	R 1 426 645.08
		ha	J Block West WRD	133.0	R 16 983.87	1	1	R 2 258 854.71
		ha	J Block West Sand Stockpile	46.5	R 16 983.87	1	1	R 789 749.96
		ha	J Block East WRD	80.2	R 16 983.87	1	1	R 1 362 106.37
		ha	J Block East Sand Stockpile	16.5	R 16 983.87	1	1	R 280 233.86
		ha	Truck staging area and north road	20.4	R 16 983.87	1	1	R 346 470.95
		ha	TUP Stockpile	12.4	R 16 983.87	1	1	R 210 599.99
		ha	Stockpile and product loading area extension	53.6	R 16 983.87	1	1	R 910 335.43
		ha	Modular crusher and stockpile area	54.3	R 16 983.87	1	1	R 922 224.14
		ha	132 KV powerline	7.7	R 16 983.87	1	1	R 130 775.80
		ha	Fuel farm	0.5	R 16 983.87	1	1	R 8 491.94

		ha	Workshop, tyre centre and oil storage	10.3	R 16 983.87	1	1	R 174 933.86
		ha	Permanent salvage yard	2.0	R 16 983.87	1	1	R 33 967.74
		ha	Temporary salvage yard	0.4	R 16 983.87	1	1	R 6 793.55
		ha	Stores yard	0.6	R 16 983.87	1	1	R 10 190.32
		ha	Hard park area and offices	10.8	R 16 983.87	1	1	R 183 425.80
		ha	Parking area	0.5	R 16 983.87	1	1	R 8 491.94
		ha	Bus station extension area	0.8	R 16 983.87	1	1	R 13 587.10
		ha	Product stockpile area	21.4	R 16 983.87	1	1	R 363 454.82
		ha	Offices area	19.1	R 16 983.87	1	1	R 324 391.92
		ha	Explosives depot	13.1	R 16 983.87	1	1	R 222 488.70
		ha	Truck staging area extension	1.9	R 16 983.87	1	1	R 32 269.35
		ha	Solar equipped boreholes and storage tanks	0.5	R 16 983.87	1	1	R 8 491.94
15 (A)	Specialist study (Screening level risk assessment)	Sum	n/a	0	R 401 550.00	1	1	R 0.00
							Subtotal 1 (Sum of items 1 to 15 Above)	R 239 923 529.31
16	Multiply Subtotal 1 by Weighting				5.0% of Subtotal 1			R 11 996 176.47
							Subtotal 2 (Subtotal 1 plus Weighting Factor 2 value)	R 251 919 705.78
17	Preliminary and General (P&G)				12.0% of Subtotal 2			R 30 230 364.69
							Subtotal 3 (Subtotal 2 plus P&G value)	R 282 150 070.47
18	Contingency				10.0% of Subtotal 2			R 25 191 970.58
							Subtotal 4 (Subtotal 3 plus Contingency value)	R 307 342 041.05
19	VAT				15.0% of Subtotal 4			R 46 101 306.16
							GRAND TOTAL FOR MINING OPERATIONS (Subtotal 4 plus VAT)	R 353 443 347.21

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