Tshipi é Ntle
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BASIC ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE ALTERNATIVE CLOSURE AND REHABILITATION PROJECT AT THE TSHIPI BORWA MINE

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

FINAL FOR DECISION MAKING PURPOSES

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

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Brandon Stobart

Reviewer

BASIS OF REPORT

EXECUTIVE SUMMARY

BACKGROUND OF CURRENT OPERATIONS

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) currently operates the Tshipi Borwa open pit manganese mine located on the farms Mamatwan 331 (mining right and surface use areas) and Moab 700 (surface use area), approximately 18 km south of Hotazel in the Joe Morolong Local Municipality and the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Tshipi is also located within the Gamagara Development Corridor, which is a Key Focus Areas for economic growth, as outlined in the municipal Integrated Development Plan and Spatial Development Framework.

Tshipi currently holds the following authorisations (included in Appendix A):

- A mining right (NC/30/5/1/2/2/0206MR) issued by the Department of Mineral Resources (DMR);
- An Environmental Management Programme report (EMPr) approved by the Northern Cape DMR;
- An Environmental Authorisation (NC/30/5/1/2/2/206/000083 EM) issued by the Northern Cape DMR in January 2018, and accompanying EMPr by the Northern DMR in January 2018;
- An Environmental Authorisation (NC/30/5/1/2/2/206/000130 MR) issued by the Northern Cape DMR in July 2019 and accompanying EMPr; and
- An Integrated Water Use Licence (IWUL) (10/D41K/AGJ/1735) issued by the Northern Cape Department of Water and Sanitation (DWS).

PROJECT BACKGROUND

The approved EMPr, as well as Tshipi's subsequent EMPrs and approvals, commits Tshipi to restore the surface to pre-mining state of wilderness and grazing and requires that the open pit is backfilled with overburden placed on waste rock dumps during mining operations. Recent optimisation investigations indicate that when considering environmental, socio-economic, technical, commercial and legal factors, completely backfilling the open pit is sub-optimal as a closure solution and an alternative closure and rehabilitation strategy offers:

- The opportunities for enhanced biodiversity habitats with a different backfill approach particularly in terms of topographic variety and access to surface water;
- The opportunities for enhanced land use increase with access to surface water; and
- An alternative closure option will allow for rehabilitation of waste rock dumps concurrent with mining instead of post mining and backfilling.

In addition to the above, completely backfilling the open pit is likely to sterilise an underground resource located to the north of the current approved open pit. The associated loss of employment, procurement expenditure, taxes and foreign exchange earnings is significant and will be a material net loss to the region and the country including the loss of foreign exchange earnings.

Tshipi is therefore proposing to change the current closure commitment to achieve a more sustainable and optimised outcome. In this regard, the proposed project focusses on:

- Concurrent backfill only (in-pit dumping) during mining operations only;

- Sloping and rehabilitation of waste rock dumps remaining on surface, concurrent with mining operations;
- Future access to readily available water supply in a pit lake; and
- Optimisation of the surface landforms and partially backfilled pit from a biodiversity, rehabilitation, land use and pollution prevention perspective.

It follows that the proposed closure land use objective is to create a sustainable closure land use which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock with associated grazing potential.

RATIONAL OF THE PROPOSED PROJECT

On 17 May 2019, the Minister of Environment, Forestry and Fisheries published the 2nd draft of the 'Proposed Regulations Pertaining to the Financial Provision for the Rehabilitation and Remediation of Environmental Damage caused by Reconnaissance, Prospecting, Exploration, Mining or Production Operations' (2nd Draft Financial Provision Regulations) for comment. The 2nd Draft Financial Provision Regulations seek to entirely replace the NEMA Financial Provisioning Regulations, published on 20 November 2015, as amended (Financial Provisioning Regulations, GNR 1147 of 2015).

The 2nd Draft Financial Provision Regulations focusses on facilitating environmentally sustainable end land uses. In this regard, the following applies:

- The 2nd Draft Financial Provision Regulations highlight that the purpose of setting aside a financial provision is to ensure that operations can achieved an approved sustainable end state at closure;
- Companies have the scope to define a credible sustainable end state in the final rehabilitation, decommissioning and mine closure plan. The sustainable end state must reflect local conditions, regulatory complexities, stakeholder expectations, environmental opportunities and technical solutions for the infrastructure and facilities to support the sustainable end state; and
- The mind shift from classic mine closure (returning the land to its pre-mining state) to focussing on a transitional economy promotes the potential for multiple alternative closure opportunities.

The proposed project offers an alternative closure and rehabilitation strategy to the approved current commitment to re-instate the environment to that of grazing and/or wilderness potential in order to align the Tshipi closure objectives with the sustainable end state focus of the 2nd Draft Financial Provision Regulations. It follows that the proposed closure land use objective is to create a sustainable closure land use which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock with associated grazing potential.

SUMMARY OF AUTHORISATION REQUIREMENTS

Prior to the commencement of the proposed project, an environmental authorisation from the Northern Cape DMR in terms of section 24 of NEMA must be applied for and obtained. The EIA Regulations being followed are Government Notice Regulation (GNR) 982 of 4 December 2014, as amended. The relevant listed activity is included in Section 3.1.

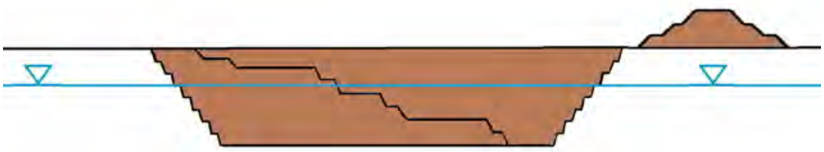
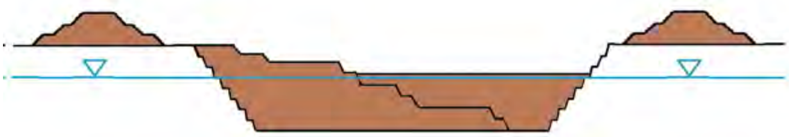
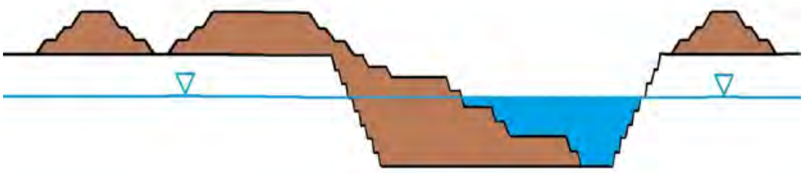
The listed activity triggers falls under GNR 983 Listing Notice 1, thereby triggering the need to undertake a basic assessment and compile and submit a Basic Assessment Report in support of the application for environmental authorisation in terms of regulation 19 of the EIA Regulations, 2014.

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

ALTERNATIVES CONSIDERED

The approved EMPr commits Tshipi to restore the surface to pre-mining state of wilderness and grazing and requires that the open pit is completely backfilled. Recent optimisation investigations indicate that when considering environmental, socio-economic, legal, commercial and technical, factors, completely backfilling the open pit is sub-optimal. Project alternatives that were considered included: complete backfill (option 1), partial backfill (option 2), concurrent backfill only (in-pit dumping) (option 3) and no backfill (option 4). The alternatives analysis has indicated that **option 3** is the preferred option from an environmental, socio-economic, technical, legal and commercial perspective.

TABLE A: PROJECT ALTERNATIVES THAT WERE CONSIDERED

Options considered	Illustration	Detail
Complete backfill (option 1)		Backfill of the final pit void post mining to original ground level, before rehabilitation of the surface as per the current approved EMPr
Partial backfill (option 2)		Backfill of the final pit void post mining to a level just above the rebound water-table level, approximately 50m below original ground level, before rehabilitation of the surface.
Concurrent backfill only (in-pit dumping) (option 3)		Backfill of the pit void concurrent with mining only, also called in-pit dumping, which results in a partial void and associated pit lake which will be 'made safe' (profiled) before rehabilitation of the surface.
No backfill (option 4)		No backfill of the pit either concurrent with mining or post mining i.e. all waste rock to surface dumps. The pit side-walls and end-walls will only be 'made safe'.

Options considered	Illustration	Detail
		The entire pit becomes a pit lake.

IMPACTS AND MANAGEMENT ACTIONS

This section provides a summary of the assessment of the potential impacts of the project and provides measures to prevent and/or mitigate the impacts. The potential impacts associated with the proposed project can be categorised into those that have low, medium and/or high significance in the unmitigated scenario. All three categories of impacts require a measure of management actions which, if successfully implemented will reduce and or enhance the significance of the impacts. Cumulative impacts and latent impacts are also summarised in the table below. In addition to this, the table also provides a summary of the positive and negative impacts comparing the impact significance rating in both the unmitigated and mitigated scenarios for the current approved commitment (option 1) versus the proposed preferred closure option (option 3).

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

TABLE B – POTENTIAL IMPACT SUMMARY

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
Geology (mineral resources)	Loss and sterilisation of mineral resources	The approved EMPr's (SLR, August 2017 and April 2019), commits Tshipi to completely backfilling the open pit at closure and as such will sterilise a deeper mineral resource located to the north of the current approved open pit because of the necessity (and associated cost) of establishment of a vertical shaft complex to access the resource that could otherwise be accessed from the highwall of the open pit. This issue is relevant to whomever in future applies to mine the underground resource. In terms of the proposed project, underground resources will be easily accessible and not sterilised. In addition, In the current approved scenario, after complete backfilling, access to selected waste rock resources will be difficult or not possible while in the scenario of the proposed project (concurrent backfill only) there is more opportunity to access selected backfill for crushing, screening and sale as building material. Related management actions focus on efficient planning and execution of concurrent backfilling. No cumulative impact or additional latent impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, this impact related to the difficulty of accessing mine residue resources primarily associated with waste rock backfilled into the open pit during complete backfilling and to a lesser degree from remaining surface residue facilities. It must be noted that at the time of completing the previous assessment, the feasibility of accessing underground resources in the future had not been contemplated and was therefore not included in the previous assessment. The proposed project therefore alters the approved	High	Low	Medium positive	High positive

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		unmitigated and mitigated impact ratings.				
Topography	Safety to third party and animals	Hazardous infrastructure and excavations include all structures into or off which third parties (persons) and animals (livestock and wild animals) can fall and be harmed. The proposed project will present final rehabilitated areas that are considered hazardous (waste rock dumps) and a partially open pit with a pit lake.). In addition to this, the proposed project allows for the early rehabilitation of waste rock dumps that have reached final form concurrent with mining activities. Related management actions include general site rehabilitation, early rehabilitation of waste rock dumps, making the pit safe and access control. No cumulative impact or additional latent impacts have been identified. This impact was assessed as part of the approved EMPr (SLR, August 2017). The proposed project does not alter the approved impact significance rating.	High	Low	High	Low
Soil and land capability	Loss of soil resources and land capability through contamination	Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. Decommissioning pollution sources include spillages of waste material, dirty water, fuel, lubricants and leaks from vehicles and equipment and run-off from waste rock dumps. Post closure infrastructure includes waste rock dumps remaining on surface that may have the potential to contaminate soil through long term run-off. Related management actions focus on controlling decommissioning activities as per the approved EMPr (pollution prevention) and rehabilitation.	High	Low	High	Low

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		No cumulative impact or additional latent impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). The proposed project does not alter the approved impact rating.				
	Loss of soil resources and land capability through physical disturbance	Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. Decommissioning activities and post closure infrastructure such as waste rock dumps remaining on surface have the potential to disturb soils and related land capability through removal, compaction and/or erosion, particularly in the unmitigated scenario. In the case of erosion, the soils will be lost to the area of disturbance. In the case of compaction, the soils functionality will firstly be compromised through a lack of rooting ability and aeration, and secondly the compacted soils are likely to erode because with less inherent functionality there will be little chance for the establishment of vegetation and other matters that naturally protects the soils from erosion. Related management actions focus on controlling decommissioning activities as per the approved EMPr (soil conservation), rehabilitation and post closure monitoring. No cumulative impact or additional latent impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). The proposed project does not alter the approved impact rating.	High	Low	High	Low
Biodiversity	Physical destruction of	Areas of high ecological sensitivity are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some	High	Medium	High	High positive

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
	biodiversity	of these areas host protected species (Grey Camel Thorn and Camel Thorn). The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas which is a key function for the broader ecosystem. The transformation of land for any purpose, including mining and associated activities, increases the destruction of the site specific biodiversity, the fragmentation of habitats, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between different areas of biodiversity importance. Decommissioning and post closure activities that result in exposed and un-revegetated areas, un-rehabilitated waste rock dumps and an un-profiled open pit in the unmitigated scenario has the potential to physically destroy biodiversity. With rehabilitation and access to a functional pit lake, aquatic habitats can be created and terrestrial habitats can be enhanced. Related management actions focus on controlling decommissioning activities as per the approved EMPr (limiting vegetation clearing, biodiversity action plan, obtaining tree permits), rehabilitation, pit lake design to support sustainable aquatic systems and post closure terrestrial ecology and post closure monitoring. No cumulative impact or additional latent impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). With mitigation the significance rating changes with a change to the closure commitment because with access to a functional pit lake, aquatic habitats can be created and terrestrial habitats can be enhanced. The proposed project therefore alters the approved mitigated impact rating.				
	General	In the absence of rehabilitation, decommissioning activities can	High	Medium	High	Medium

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
	disturbance of biodiversity	generally disturb biodiversity through the presence of exposed areas, contaminated soil, alien invasive species an un-profiled pit and anthropogenic activities which in turn effects the success of rehabilitation. The closure phase may also present contaminated water within the pit lake, that if consumed may be harmful to vertebrates and invertebrates without mitigation. In terms of the proposed project, with successful rehabilitation and revegetation, a suitable aquatic habitat (inclusive of suitable water quality within the pit lake) and terrestrial habitat will be created. This will promote the natural relocation of faunal species and reintroduction of floral species into the area, thereby restoring and enhancing biodiversity complexity, diversity, community sensitivity and overall community stability. Related management actions focus on controlling decommissioning activities as per the approved EMPr (rehabilitation, alien and invasive species programme, zero tolerance animal killing policy, veld fire prevention, speed control and pollution preventing) and monitoring. No cumulative impact or additional latent impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In terms of the proposed project, with access to a functional pit lake, suitable aquatic and terrestrial habitats can be created and enhanced that in turn will encourage the natural relocation of faunal species and reintroduction of floral species into the area. The proposed project therefore alters the approved mitigated impact rating.				positive
Surface	Alternation of natural drainage patter	During the closure phase, stormwater management infrastructure to contain dirty water as required by legislation will be required around the perimeter of the waste rock dumps. In this regard the collection of rainfall and runoff will be via toe paddocks. The toe paddocks will	Medium	Low	Medium to Low	Low

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		remain until such time as the waste rock dumps have been rehabilitated successfully, after which they can be removed. Further to this, natural surface water run-off and rainfall will also be collected in the partially open pit. The collected rain-fall and run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns in a similar manner to what is currently occurring on site and will perpetuate during the decommissioning phase. Related management actions focus on rehabilitation to restore natural drainage patterns where possible. No cumulative impact or additional latent impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, with rehabilitation at closure natural drainage patterns would be restored. In terms of the proposed project, the alteration of natural drainage patterns for the partially open pit cannot be mitigated; however it is important to note that the collection of rainfall and run-off in the partially open pit does contribute to the development of the pit lake which can be used for alternative uses. The end ratings remain similar.				
	Contamination of surface water resources	Decommissioning activities that have the potential to pollution surface water resources include sedimentation from erosion, spillages (waste material dirty water, fuel, lubricants and leaks), contaminated soil and run-off from waste rock dumps. Post closure activities that have the potential to pollute surface water resources include contaminated pit lake water, sedimentation from erosion and run-off from waste rock dumps. It is unlikely that contaminates will reach the nearest water course (Vlermuisleegte), given that it is located two km west of the mine and is ephemeral in nature and is therefore associated with long	Medium	Low	High	Low

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		periods of no flow. In terms of the pit lake, in the unmitigated scenario, the water can become contaminated over time. Management actions focus on pollution prevention, rehabilitation, monitoring, establishment of floating wetlands (required to treat pit lake water to meeting DWS livestock watering objectives) and compensation for any water related loss. A potential latent impact could be associated with long terms deterioration of pit lake water quality subject to the success of the ongoing floating wetland treatment. If this latent impact manifests and cannot be mitigated through treatment adaptations then the use of/access to the pit lake will have to be reconsidered. The associated default management measures will be to fence and/or berm off access to the pit lake. No cumulative impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). The proposed project introduces issues associated with the pit lake which changes the approved impact rating in the unmitigated scenario. There is no difference in the impact ratings in the mitigated scenario.				
Groundwater	Lowering of groundwater levels	Prior to mining the natural depth of the water in surrounding boreholes ranged from 25 to 55 m below ground level. Groundwater level monitoring data currently shows water depths ranging from 41 to 75 m below ground level. At decommissioning (when mining stops), the modelled cone of drawdown developed due to dewatering is predicted to be at a maximum extent of 5.5 km to the east and 8.3 km to the west of the Tshipi Borwa Mine. Third parties within the simulated cone of depression may therefore experience a drop in water levels. When mining and dewatering cease, groundwater levels will start to rebound	Insignificant			

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		and the water level in the pit will increase. Over time, as the pit lake level rises inflows will diminish until a steady state level is reached. Due to evaporative loses and pit geometry; the partially filled pit will continue to be a hydraulic sink in perpetuity because the steady state pit lake level will remain approximately 6m below the natural groundwater level which is approximately 35 below ground level. The associated cone of depression hydraulic gradient will be significantly reduced. It follows that groundwater levels at off-site third party boreholes are predicted to rebound to natural groundwater level. This impact is therefore considered to be insignificant. Related management actions focus on monitoring groundwater levels and compensation for loss of water supply. No cumulative impact or additional latent impacts have been identified. This impact was not assessed as part of the approved EMPr's (SLR, August 2017 and April 2019) given that it was assumed groundwater levels in off-site third party boreholes rebounded to natural ground level at closure. The proposed project does not alter the approved impact rating.				
	Contamination of groundwater resources	The closure phase will present final land forms such as waste rock dumps remaining on surface and the waste rock backfilled into the open pit that may have the potential to pollute water resources through long term seepage and/or run-off. As part of the proposed project, the partially backfilled pit will act as a hydraulic sink and as such the extent of the pollution plume will reduce because the draw down cone will draw some of the pollution plume into the pit. No impact on any off-site third party boreholes is predicted. Related management actions focus on monitoring groundwater quality and compensation for loss of water	Low	Low	Low	Low

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		supply. No additional latent impacts have been identified. Modelling results includes contributions from off-site sources in the context of current water quality. The predicted modelled results therefore are cumulative in nature. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). The proposed project does not change the approved impact rating, however the proposed project minimises the extent of the pollution plume because of the hydraulic sink associated with the partially backfilled pit.				
Air	Air pollution	The main contaminants associated with the proposed project include: inhalable particulate matter less than 10 microns in size (PM10 and PM2.5), larger total suspended particulates (TSP) that relate to dust fallout, Mn concentration (within waste rock dumps), and gaseous emissions mainly from vehicles and generators. At closure, the main source of windblown dust will be from the exposed land and waste rock dump surfaces. These contaminates have the potential to contribute to the pollution of air. It is however important to note that modelling results indicated that exceedances of the PM10, PM2.5, dust fallout and Mn concentrations are unlikely to be experienced at sensitive receptors. Related management actions focus on monitoring and dust suppression (particularly during the decommissioning phase). No additional latent impacts have been identified. Modelling results includes contributions from off-site sources in the context of current air quality. The predicted modelled results therefore are cumulative in nature.	High	Medium (remained High for Mn)	Low	Low

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). The impact was rating remained high for Mn concentrations even with mitigation as modelling predicted that exceedances of the World Health Organisation (WHO) guidelines were expected at some residence near the mine. It is important to note that since the compilation of the previous EIA/EMPrs, the Mn content concentrations within the waste rock dumps at Tshipi have been sampled. The new information demonstrates that there is less Mn content than previously assumed. It follows that for the proposed project, the approved mitigated impact rating has changed.				
Noise	Increase in disturbing noise levels	Noise pollution can create nuisance that will have different impacts on different receptors because some are very sensitive to noise and others are not. Potential human noise receptors include the isolated residences and farmhouses within 2 km radius of the Tshipi Borwa Mine. Based on the prevailing wind field, disturbing noise levels are expected to be more notable to the east and south during the day and to the north and north-northwest during the night. Post closure activities that may generate disturbing noise levels include intermitted vehicle and materials handling activities associated with post closure monitoring, maintenance and aftercare. Existing operational baseline noise at the Tshipi Borwa mine is below the IFC guideline for residential areas, and as part of on-site monitoring, no audible noise from the mining operations were noted, only noise from cicadas (insects). Related management actions focus on noise attenuation, equipment and vehicle maintenance and limiting traffic to day time hours. No cumulative impact or additional latent impacts have been identified.	Not applicable	Not applicable	Low	Low

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		This impact was not assessed as part of the approved EMPr's (SLR, August 2017 and April 2019) as noise disturbances and noise nuisance activities were limited to all phases prior to closure. The proposed project presents addition monitoring, aftercare and maintenance/adjustment requirements (creating of aquatic habitats) and as such alters the impact rating.				
Visual	Negative visual views	The visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the visual landscape within the Tshipi Borwa Mine area has been transformed due to the presence of approved mining infrastructure and activities. In general, the visual landscape of the area surrounding the Tshipi Borwa Mine is characterised by flat open areas associated with semi-arid vegetation and an ephemeral river (Vlermuisleegte River), that has been influenced by the presence of existing mining operations, roads, powerline infrastructure and isolated farmsteads. The proposed project will present visual intrusions (waste rock dumps remaining on surface and a partially open pit) post closure that may be perceived negatively by sensitive receptors, particularly in the unmitigated scenario were rehabilitation activities during decommissioning have not been implemented. It is however important to note that Tshipi is located adjacent to existing mining operations (UMK and Mamatwan), which has resulted in a deteriorated the natural landscape. Related management actions focus on rehabilitation and in particular early rehabilitation of waste rock dumps as part of current mining operations. No latent impacts have been identified. Assessing impacts in the context of surrounding mines provides a cumulative impact assessment perspective.	High	Low	High	Low

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). The proposed project does not alter the impact rating; however the state of rehabilitation of closure will be improved in the mitigated scenario through the early rehabilitation of the waste rock dumps.				
Traffic	Road disturbance and traffic safety	The proposed project will not generate additional traffic and as such project-related road disturbance and traffic safety impacts are not expected to occur. No cumulative impact or additional latent impacts have been identified.	Insignificant			
Heritage/cultural and palaeontological resources	Loss of heritage/cultural and palaeontological resources	No heritage resources occur at the Tshipi Borwa Mine. In addition, there is a low possibility of palaeontological resources occurring in the area. However, related management actions focus on the steps required in the unlikely event of a chance find. No cumulative impact or additional latent impacts have been identified.	Insignificant			
Socio-economic	Inward migration	Mining operations tend to bring with them an expectation of employment in all phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Impacts associated with inward migration were assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). While the rehabilitation plan and closure plan will have been adjusted in order to cater for the proposed project and a change to the closure objective, the proposed project will not present any additional job opportunities as Tshipi will make use of existing contractors and workers as part of rehabilitation activities. It follows	Insignificant			

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
		that the potential for an increased social risks is considered to be negligible for the proposed project. Related management actions focus on implementing the approved EMPr commitments relating to recruitment, communication and health awareness training. No cumulative impact or additional latent impacts have been identified.				
	Economic impact	Mining has a positive net economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees. In the current approved scenario, the open pit is completely backfilled and the land is reinstated to that of grazing/wilderness. From a net economic perspective, the economy will lose an estimated value of more than R 21.4 billion on a national regional and local level because the completely backfilled pit will prohibit the access to future underground resources. In terms of the proposed project, the national, regional and local economies will gain R21.5 billion because the partially backfilled pit allows easy access to underground resources. Related management actions focus on efficient planning and execution of concurrent backfilling only (in-pit dumping) No latent impacts have been identified. This impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). It must be noted that at the time of completing the previous assessment, the feasibility of accessing underground resources in the future had not been contemplated and was therefore not included in the previous assessment and as such the impact rating changes.	Medium to high positive	Medium to high positive	High positive	High positive

Aspect	Potential impact	Summary of impact discussion and reference to mitigation measures for the proposed project	Impact significance (approved EMPr) – option 1		Impact significance (proposed project) – option 3	
			Unmitigated	Mitigated	Unmitigated	Mitigated
Land use	Change in land use	Mining-related activities have the potential to affect land uses both within the mine area and in the surrounding areas. The key related potential environmental impacts include soil, land capability, biodiversity, water, air, noise, visual, and economic impacts. The approved EMPr's (SLR, August 2017 and April 2019), requires that the surface is reinstated to pre-mining state of wilderness and grazing and requires that the open pit is backfilled at closure. The proposed project is proposing a change to this strategy, where the closure land use objective is to create a sustainable closure land use which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock with associated grazing potential. Related management measures focus on rehabilitation. No latent impacts have been identified. Depending on the nature and scale of surrounding mining activities at the post closure stage, this could be cumulative impact category. This impact was assessed as part of the approved EMPr's (SLR, August 2017 April 2019). The proposed project presents a change in the closure strategy and creates and enhances alternative land uses (terrestrial and aquatic habitats) and provides a water resource for livestock watering with associated grazing potential. The proposed project therefore alters the approved mitigated impact rating.	High	Low	High	High positive

IMPACT STATEMENT

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

STAKEHOLDER ENGAGEMENT PROCESS

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

This BAR was distributed for a 30 day comment period from **20 August 2019 to 20 September 2016** in order to provide I&APs with an opportunity to comment on any aspect of the proposed project and the findings of the Basic Assessment process. Copies of the full report were made available on the SLR website (at https://slrconsulting.com/za/slr-documents/) and at the Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Hotazel Public Library and Kathu Public Library, Black Rock Library. Electronic copies (compact disk) of the report were made available from SLR, at the contact details provided below.

All comments received during the review process have been included in this BAR. Issues and concerns raised including responses are included in Section 7.3.

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APPENDICES

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
ABA	Acid base accounting
ADEs	Aquifer Dependent Ecosystems
Al	Aluminium
AMSL	above mean sea level
AP	Acid Potential
BAR	Basic Assessment Report
BID	Background Information Document
CARA	Conservation of Agricultural Resources Act, 1983 (No. 43 of 1983)
CBAs	critical biodiversity areas
CEC	cation exchange capacity
CH4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CoCs	chemicals of concern
DAFF	Northern Cape Department of Agriculture, Forestry and Fisheries
DMR	Northern Cape Department of Mineral Resources
DO	dissolved oxygen
DWS	Northern Cape Department of Water and Sanitation
EAP	environmental assessment practitioners
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme report
ESAs	Ecological Support Areas
Fe	Iron
GNR	Government Notice Regulation
HCs	hydrocarbons
Hg	mercury
I&APs	Interested and Affected Parties
IBAs	Important Bird Areas
ICP	Inter Coupled Plasma Scan
IDP	Integrated Development Framework
IWUL	Integrated Water Use Licence
LMO	Lower Manganese Ore Body
MAR	mean annual run-off
mcm	million cubic meters
MMO	Middle Manganese Ore Body

Acronym / Abbreviation	Definition
Mn	Manganese
MPRDA	Mineral and Petroleum Resources Development Act (No. 28 of 2002)
MS	Mass Spectrometry
N	Nitrate
NAAQS	National Ambient Air Quality Standards
NCNCA	Northern Cape Nature Conservation Act (No. 9 of 2009)
NCPSPF	Northern Cape Provincial Spatial Development Framework
NDCR	National Dust Control Regulations
NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (No. 107 of 1998)
NEMA:QA	National Environmental Management: Air Quality Act (No. 39 of 2004)
NEM:WA	National Environmental Management: Waste Act (No. 59 of 2008)
NFA	National Forests Act (No. 84 of 1998)
NO_2	nitrogen dioxide
NP	Neutralization Potential
NPAES	National Protected Areas Expansion Strategy, 2008
NPR	Neutralising Potential Ratio
NWA	National Water Act (No. 36 of 1998)
ONA	Other Natural Areas
P	phosphorus
PMP	probable maximum precipitation
SACAD	South Africa Conservation Areas Database
SACNASP	South African Council for Natural Scientific Professional
SAHRA	South African Heritage Resources Agency
SAPAD	South Africa Protected Area Database
SAS	Scientific Aquatic Services
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
Se	Selenium
SLR	SLR Consulting (Africa) (Pty) Ltd
SO_2	sulphur dioxide
SPLP	Synthetic Precipitation Leaching Procedure
TDS	Total dissolved solids
TSP	total suspended particulates
UMK	United Manganese of Kalahari
UMO	Upper Manganese Ore Body
WET	Whole Effluent Toxicity

Acronym / Abbreviation	Definition
WHO	World Health Organisation

INTRODUCTION

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

BACKGROUND OF CURRENT OPERATIONS

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) currently operates the Tshipi Borwa open pit manganese mine located on the farms Mamatwan 331 (mining right and surface use areas) and Moab 700 (surface use area), approximately 18 km south of Hotazel in the Joe Morolong Local Municipality and the John Taolo Gaetsewe District Municipality in the Northern Cape Province (refer to Figure 1 and Figure 2). Tshipi is also located within the Gamagara Development Corridor, which is a Key Focus Areas for economic growth, as outlined in the municipal IDP and SDF.

Tshipi currently holds the following authorisations (included in Appendix A):

- A mining right (NC/30/5/1/2/2/0206MR) issued by the Northern Cape DMR;
- An EMPr approved by the Northern Cape DMR;
- An Environmental Authorisation (NC/30/5/1/2/2/206/000083 EM) issued by the Northern Cape DMR in January 2018, and accompanying EMPr by the Northern Cape DMR in January 2018;
- An Environmental Authorisation ((NC/30/5/1/2/2/206/000130 MR) issued by the Northern Cape DMR in July 2019 and accompanying EMPr; and
- An Integrated Water Use Licence (IWUL) (10/D41K/AGJ/1735) issued by the Northern Cape DWS.

PROJECT BACKGROUND

The approved EMPr, as well as Tshipi's subsequent EMPrs and approvals, commits Tshipi to restore the surface to pre-mining state of wilderness and grazing and requires that the open pit is backfilled with overburden placed on waste rock dumps during mining operations. Recent optimisation investigations indicate that when considering environmental, socio-economic, technical, commercial and legal factors, completely backfilling the open pit is sub-optimal as a closure solution and an alternative closure and rehabilitation strategy offers:

- The opportunities for enhanced biodiversity habitats with a different backfill approach particularly in terms of topographic variety and access to surface water;
- The opportunities for enhanced land use increase with access to surface water; and
- An alternative closure option will allow for rehabilitation of waste rock dumps concurrent with mining instead of post mining and backfilling.

In addition to the above, completely backfilling the open pit is likely to sterilise an underground resource located to the north of the current approved open pit. The associated loss of employment, procurement expenditure, taxes and foreign exchange earnings is significant and will be a material net loss to the region and the country including the loss of foreign exchange earnings.

Tshipi is therefore proposing to change the current closure commitment to achieve a more sustainable and optimised outcome. In this regard, the proposed project focusses on:

- Concurrent backfill only (in-pit dumping) during mining operations only;
- Sloping and rehabilitation of waste rock dumps remaining on surface, concurrent with mining operations;
- Future access to readily available water supply in a pit lake; and
- Optimisation of the surface landforms and partially backfilled pit from a biodiversity, rehabilitation, land use and pollution prevention perspective.

Tshipi is proposing the above change to all approvals issued to the Mine insofar as the closure objective and commitment is concerned.

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

PURPOSE OF THIS REPORT

This Basic Assessment Report (BAR) has been compiled and distributed for review and comment as part of a Basic Assessment process that is being undertaken for the proposed project, as contemplated in the Environmental Impact Assessment (EIA) Regulations, 2014 (published under Government Notice Regulation (GNR) 982 of 4 December 2014, as amended) of the National Environmental Management Act, 1998 (No. 107 of 1998), as amended (NEMA).

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

Interested and Affected Parties (I&APs) are asked to comment on the BAR. The document will then be updated into a final report, giving due consideration to the comments received. The BAR will be submitted to the DMRE for consideration as part of the application for Environmental Authorisation in terms of Chapter 5 of NEMA.

SUMMARY OF AUTHORISATION REQUIREMENTS

Prior to the commencement of the proposed project, an environmental authorisation from the Northern Cape DMR in terms of section 24 of NEMA must be applied for and obtained. The EIA Regulations being followed are Government Notice Regulation (GNR) 982 of 4 December 2014, as amended. The relevant listed activity is included in Section 3.1.

The listed activity triggers falls under GNR 983 Listing Notice 1, thereby triggering the need to undertake a basic assessment and compile and submit a Basic Assessment Report in support of the application for environmental authorisation in terms of regulation 19 of the EIA Regulations, 2014.

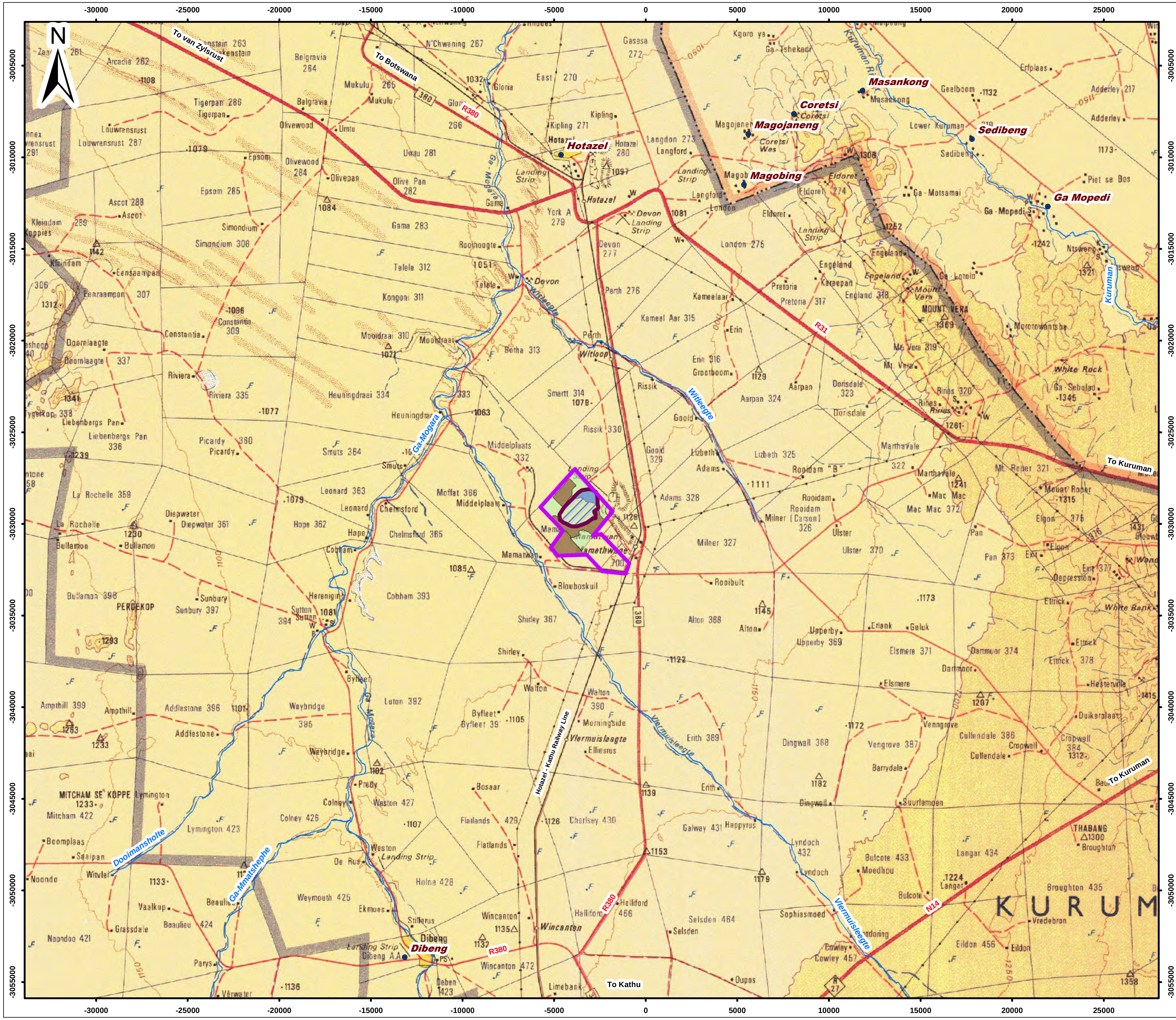
TERMS OF REFERENCE

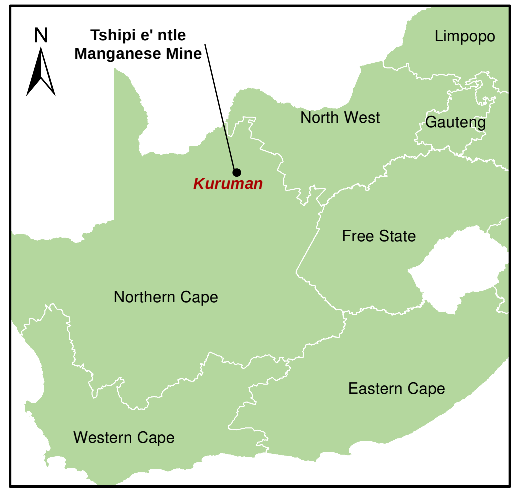
SLR, as the independent EAP, is responsible for undertaking the required environmental regulatory process and conducting the public participation process. The terms of reference for the environmental regulatory process are to:

- Make application for Environmental Authorisation of the proposed project in terms of NEMA;
- Ensure the Basic Assessment process is undertaken in accordance with the requirements of NEMA;
- Ensure the Basic Assessment is undertaken in an open, participatory manner to ensure that all potential impacts are identified;
- Undertake a formal public participation process, which includes the distribution of information to interested and affected parties (I&APs) and provides the opportunity for I&APs to raise any concerns/issues, as well as an opportunity to comment on all BA documentation; and
- Integrate all the information, including the findings of the specialist studies and other relevant information, into a BAR to allow an informed decision to be taken on the proposed project.

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

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





Legend

- Tshipi Surface Use Area
- Tshipi Mining Right Area
- Open Pit
- Concurrent In-Pit Dumping
- Waste Rock Dumps
- Place Names
- Main Roads
- Power Line
- Rivers and Streams
- 20m Contour Lines

0 2 000 4 000 Meters

Scale: 1:200 000 @ A3

Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 1

Regional Setting

SLR

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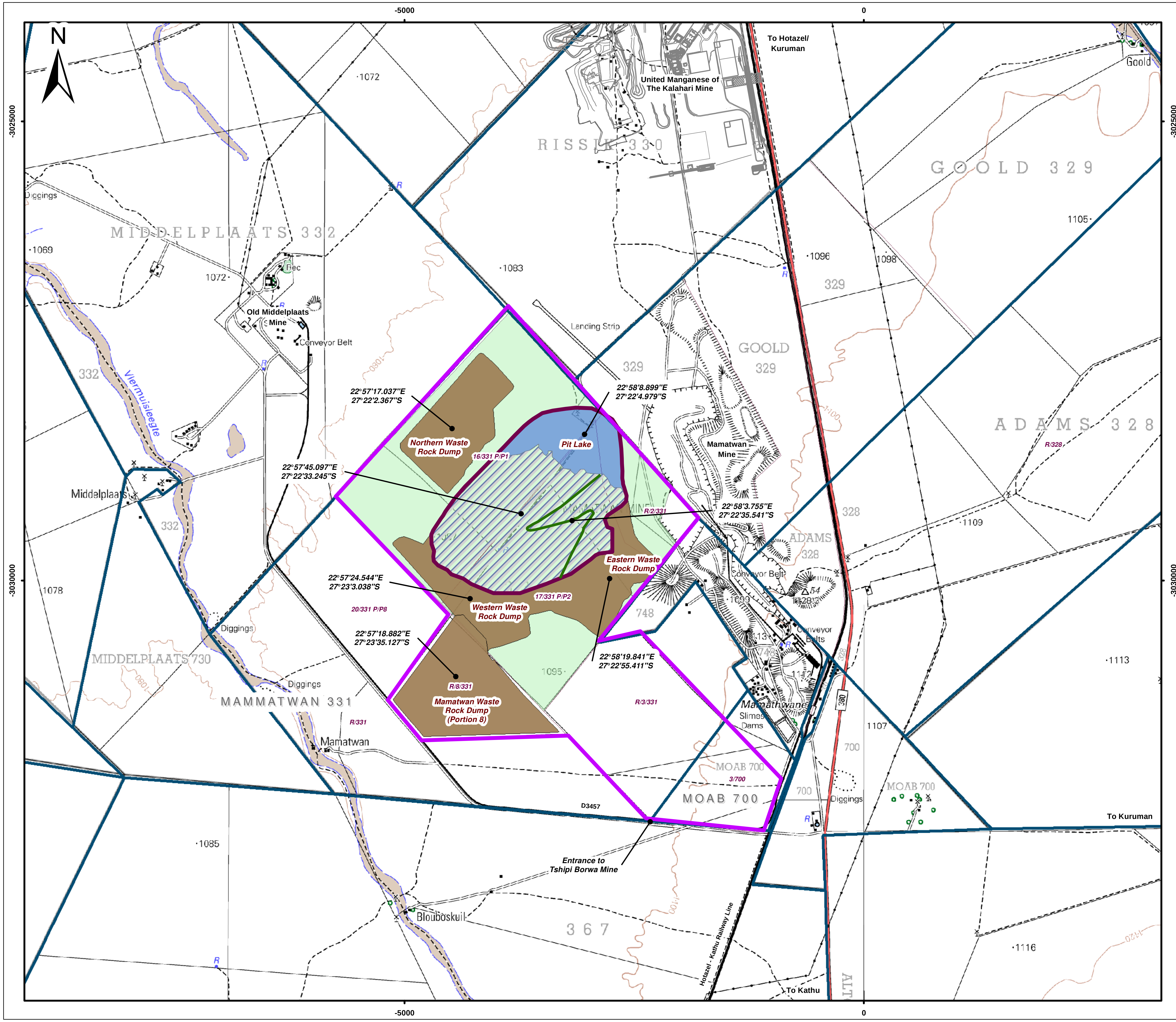
710.20008.00069 | 2019/07/30



Legend

- Tshipi Surface Use Area
- Tshipi Mining Right Area
- Open Pit
- Concurrent In-Pit Dumping
- Waste Rock Dumps
- Access Road
- Main Roads
- Power Line
- Rivers and Streams
- 20m Contour Lines
- Farm Boundaries
- Farm Portions

0 500 1 000 Meters

Scale: 1:40 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 2

Local Setting

SLR

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710.20008.00069 | 2019/07/30

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PART A - SCOPE OF ASSESSMENT AND BASIC ASSESSMENT REPORT

1 DETAILS OF THE EAP

1.1 DETAILS OF THE EAP WHO PREPARED THE REPORT

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

TABLE 1-1: DETAILS OF THE EAP

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

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

1.2 EXPERTISE OF THE EAP

Natasha Smyth holds a BSc Honours degree in Geography and Environmental Management and has approximately 10 years of relevant experience (curriculum vitae attached in Appendix B). Brandon Stobart holds a BA in Economics and Environmental Science and has over 20 years of relevant experience (Curriculum Vitae attached in Appendix B) and is registered as an environmental assessment practitioner with the interim certification board. The proof of this registration is attached in Appendix B. Both Natasha Smyth and Brandon Stobart have been involved in several impact assessments for large scale mining development in Southern Africa.

1.3 SLR PROJECT TEAM

Further detail pertaining to the roles and responsibilities of the project team (EAP and specialists) is provided in Table 1-2 below.

TABLE 1-2: PROJECT TEAM

Company	Name and designation	Role and responsibility
EAP team		
SLR	Brandon Stobart – Project Director	• Project reviewer
	Natasha Smyth – Project Manager	• Management of the EIA and EMPr process • Co-ordination of specialists • Co-ordination of public consultation process and liaison with regulators

Company	Name and designation	Role and responsibility
		• Scoping and EIA and EMP report compilation
Specialist team		
Scientific Aquatic Services	Stephen van Staaden - Biodiversity specialist	• Terrestrial and aquatic assessment and reporting
Graham Young Landscape Architect	Graham Young – Visual specialist	• Visual assessment and reporting
SLR	Mihai Muresan - Hydrogeologist	• Groundwater assessment, modelling and reporting
	Steve van Niekerk – Closure specialist	• Development of closure plan and cost calculations
	Kevin Bursey - Hydrologist	• Surface water rainfall and runoff modelling and reporting
	Matt Goode - Hydrologist and hydro-geologist	• Pit lake modelling and reporting
	Jaime Robinson - Geochemist	• Geochemistry modelling and reporting
Airshed Planning Professionals	Hanlie Lieberberg-Enslin – Air specialist	• Air quality assessment, modelling and reporting
	Renee von Grunewaldt – Noise specialist	• Noise assessment and reporting
Mercury	Werner Neethling Economic specialist	• Socio-economic assessment and reporting
Terra Africa	Mariné Pienaar – Soil and land capability specialist	• Soil and land capability assessment and reporting

2 LOCATION OF ACTIVITY

2.1 LOCATION OF OVERALL ACTIVITY

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

TABLE 2-1: DESCRIPTION OF THE PROPERTY

Description	Details
Farm name specific to the listed activity	• Mamatwan 331 portion 17 (previously a portion of portion 2)
Application area (ha) specific to listed activity	• The proposed listed activity (road) covers an area of approximately 7.5 ha.
Farm Names for the mine surface use area and associated activities	• Mamatwan 331 portion 16 (previously a portion of portion 1); • Mamatwan 331 portion 17 (previously a portion of portion 2); • Mamatwan331 portion 18 (previously a portion of portion 3); • Mamatwan 331 portion 8; and • Moab 700 (remaining extent).
Application area (ha) for the mine surface use area and associated activities	• Approximately 1446 ha
Magisterial district	Located within the Kuruman Magisterial District and in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality
Distance and direction from nearest town	The Tshipi Borwa Mine is located approximately 18km to the South East of the town of Hotazel (Refer to Figure 1).
21 digit Surveyor General Code for each farm portion	• CO0000000000033100016 - Mamatwan 331 portion 16; • CO0000000000033100017 - Mamatwan 331 portion 17; • CO0000000000033100018 - Mamatwan 331 portion 18; • CO0000000000033100008 - Mamatwan 331 portion 8; and • CO0000000000070000000 – Moab 700 (remaining extent).
Co-ordinates (Refer to Figure 2)	• Northern waste rock dump – 22° 57' 17.03'' E and 27° 22' 2.36'' S • Eastern waste rock dump – 22° 58' 19.84'' 27 E and 27° 22' 55.41'' S • Western waste rock dump – 22° 57' 24.54'' E and 27° 23' 3.038'' S • Mamatwan (portion 8) waste rock dump – 22° 57' 18.88'' E and 27° 23' 35.12 S • Backfilled pit – 22° 57' 45.09'' E and 27° 22' 33.24'' S • Pit lake – 22° 58' 8.89 ''E and 27° 22' 4.97'' S • Access road – 22° 58' 3.75'' E and 27° 22' 35.54'' S

2.2 LOCALITY MAP

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

3 DESCRIPTION OF THE SCOPE OF THE ACTIVITY

3.1 LISTED AND SPECIFIED ACTIVITIES

The proposed project triggers a listed activity for which environmental authorisation is required in terms of section 24 of NEMA. Details pertaining to the listed activity are included in the table below. The legislative context pertaining to the relevant listed activity is outlined in the table below. The main project activities are also included in the table below.

There is no specific requirement at this time for Tshipi to obtain a water use licence from the Northern Cape DWS in terms of the NWA for the proposed project. After closure, the relevant land user would have to review the need for a water use licence depending on the related future use of the water resource. This may include an abstraction licence to use water from the pit lake.

TABLE 3-1: PROJECT ACTIVITIES AND ASSOCIATED LISTED ACTIVITIES

Main project activity	Aerial extent of the activity (ha)	Listed activity (mark with an x)	Listed activity number, applicable listing notice and activity description
Backfilled pit	• Approximately 229 ha	Not applicable	Not applicable
Waste rock dumps remaining on surface	• Northern Waste Rock Dump (95 ha) • Mamatwan portion 8 Waste Rock Dump (128 ha) • Western and Eastern Waste Rock Dump (151 ha)	Not applicable	Not applicable
Access to readily available future water supply (pit lake)	• Approximately 65 ha	Not applicable	Not applicable
Road to the pit lake	• Road will be a re-purposed haul-ramp and is estimated to be 30 m wide with a length of approximately 2.5km (7.5 ha).	X	**GNR 983. Listing Notice 1:** Activity 24: The development of a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters (but excluding a road which is one kilometre or shorter) *Establishment of a 30m wide road that is longer than one kilometre.*
Alternative land uses	• Approximately 1446 ha	Not applicable	Not applicable

3.2 DESCRIPTION OF ACTIVITIES

This section has been compiled using information provided by specialists and the Tshipi project team.

3.2.1 PROPOSED PROJECT OVERVIEW

Tshipi currently operates the Tshipi Borwa (manganese) Mine located on the farms Mamatwan 331 (mining right and surface use areas) and Moab 700 (surface use area) in accordance with an approved EMPr. Tshipi is located within the Gamagara Development Corridor, which is a Key Focus Areas for economic growth, as outlined in the municipal IDP and SDF.

Key mine infrastructure includes an open pit, haul roads, run-of mine ore tip, a primary crusher, a secondary crushing and screening plant, various stockpiles for crushed and product ore, a train load-out facility, a private siding, offices, workshops, warehouses and ancillary buildings, an access control facility, various access roads, diesel generator house, electrical reticulation, clean and dirty water storage dams, water reticulation pipelines and drains, topsoil stockpiles and waste rock dumps.

The approved EMPr, as well as Tshipi's subsequent EMPrs and approvals, commits Tshipi to restore the surface to pre-mining state of wilderness and grazing and requires that the open pit is backfilled with overburden placed on waste rock dumps during mining operations. Recent optimisation investigations indicate that when considering environmental, socio-economic, technical, commercial and legal factors, completely backfilling the open pit is sub-optimal as a closure solution and an alternative closure and rehabilitation strategy offers:

- The opportunities for enhanced biodiversity habitats with a different backfill approach particularly in terms of topographic variety and access to surface water;
- The opportunities for enhanced land use increase with access to surface water; and
- An alternative closure option will allow for rehabilitation of waste rock dumps concurrent with mining instead of post mining and backfilling.

In addition to the above, completely backfilling the open pit is likely to sterilise an underground resource located to the north of the current approved open pit. The associated loss of employment, procurement expenditure, taxes and foreign exchange earnings is significant and will be a material net loss to the region and the country including the loss of foreign exchange earnings.

Tshipi is therefore proposing to change the current closure commitment to achieve a more sustainable and optimised outcome. In this regard, the proposed project focusses on:

- Concurrent backfill only (in-pit dumping) during mining operations only;
- Sloping and rehabilitation of waste rock dumps remaining on surface;
- Future access to readily available water supply in a pit lake; and
- Optimisation of the surface landforms and partially backfilled pit from a biodiversity, rehabilitation, land use and pollution prevention perspective.

Tshipi is proposing the above change to all approvals issued to the Mine insofar as the closure objective and commitment is concerned.

It follows that the proposed closure land use objective is to create a sustainable closure land use which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock with associated grazing potential.

3.2.2 DECOMMISSIONING AND CLOSURE PHASE

In broad terms the decommissioning phase will focus on removal of infrastructure and preparation of the site for final rehabilitation and closure. It is anticipated that the decommissioning phase will last for approximately two to five years during which period as many as 20 employees and numerous contractors with their employees will be retained on site for the associated work. Decommissioning activities include:

- Surface infrastructure will be demolished and removed, with the exception of the waste rock dumps and pit access road. Rehabilitation of the waste rock dumps will have started during the operational phase and will be completed during decommissioning. The relevant specification is included in Section 3.2.8.1;
- All demolition material and waste will be removed from the project area and disposed of appropriately i.e. inert materials into the pit and hazardous waste to an appropriately licensed disposal facility;
- All contaminated soil will either be treated in-situ or removed from the project area and disposed of appropriately; and
- Areas where infrastructure has been removed will be levelled and prepared for rehabilitation in accordance with the topography and topsoil (Section 3.2.7.1) and revegetation plans (Section 3.2.7.2).

At the end of the decommissioning phase the site will be ready for closure (the closure phase). The key activities during the closure phase will be:

- Monitoring;
- Aftercare; and
- Maintenance/ adjustment as required.

The key elements listed above are discussed in further detail in separate headings below. Additional information is provided in the EMPr section of the BAR.

With reference to Section 5.3, should the current draft NEMA Financial Provision Regulations be approved then the re-purposing of infrastructure to achieve a ‘sustainable closure’ will also be considered.

3.2.3 REMOVAL OF INFRASTRUCTURE

As per the approved EMPr (SLR, August 2017 and April 2019) all fixed infrastructure, equipment and services including foundations will be removed. After removal the land will be rehabilitated where required (for example contaminated land related rehabilitation), and prepared for placement of topsoil and vegetation as per the topsoil and revegetation plans included in Sections 3.2.7.1 and 3.2.7.2. The only modification to this might be the retention of certain buildings if a suitable use is identified.

3.2.4 CONCURRENT BACKFILL ONLY (IN-PIT DUMPING)

The proposed project presents an alternative backfill strategy to that of the approved EMPr, which currently commits Tshipi to completely backfill the open pit. Concurrent backfilling only (in-pit dumping) involves backfilling the open pit concurrently with mining operations in a manner that still allows for the provision of a safe working space within the pit for Tshipi personnel and contractors. It is important to note that Tshipi currently undertakes concurrent in-pit dumping and as such the proposed project will allow for the continuation of current practices. However, the nature of the pit is such that there is continually more waste rock generated than capacity in the worked-out area of the pit and the balance must be dumped on surface waste rock dumps.

3.2.5 DEVELOPMENT OF A PIT LAKE

The concurrent backfilling only (In-pit dumping) will result in more than half (approximately 75%) of the pit being backfilled with waste rock. Part of the remaining void will over time develop into a pit lake. The section below outlines the characteristics of the pit lake. This section has been informed by the pit lake specialist study undertaken for the proposed project (SLR, June 2019) and is included in Appendix H.

3.2.5.1 Final Pit Geometry

The final pit geometry will consist of the near-vertical benches on the high-wall and end-wall sides of the pit and the contoured backfill terraces on the low-wall side of the pit. The high-wall and end-wall perimeters will be protected from inadvertent access by security fencing, signage and berms.

3.2.5.2 Access

As part of the proposed project, a haul-ramp will be re-purposed into an access road which will be established in order to gain access to the pit lake. This road will remain in perpetuity and will be established from gravel and will be 30m wide. The location of the road is illustrated in Figure 4.

3.2.5.3 Pit lake basic principles

Mine pit lakes differ physically from natural lakes in having a higher ratio of depth to surface area. This is described by percent relative depth, which is defined as the percentage of a lake's maximum depth compared to its width calculated from its surface area by assuming the lake is approximately circular. A typical natural lake has a relative depth of less than 2%, although some may exceed 5%. Pit lakes commonly have relative depths between 10% and 40%. The Tshipi pit will have a percent relative depth of 13%. This will cause the pit lake to easily stratify with the consequential changes in chemical characteristics with depth (layering).

Once mining activities cease, groundwater levels will begin to rebound. The water level will begin to rise back towards the pre-mining level. The main water sources (inflows into the pit) include the following:

- Direct rainfall onto the surface of a pit lake/flood of pit;
- Runoff from rainfall falling onto the pit walls (high-wall runoff); and
- Groundwater which seeps into the pit.

Water losses (outflows) occur through evaporation from the pit.

3.2.5.4 Hydraulic sink

The pit lake will act as a hydraulic sink. This means that water levels in the pit will remain below surrounding groundwater levels. Hydraulic sinks are normally found in arid climates. Initially, inflows will be high, because the hydraulic gradient driving inflows from the aquifer would be at a maximum due to the water level being at the base of the pit. Due to evaporative losses and pit geometry the pit lake is associated with a cone of depression in the water table with the groundwater gradient towards the pit. As evaporation is the only discharge pathway, soluble metals accumulate due to evapo-concentration.

3.2.5.5 Filling rates and final levels

Modelling indicates that it will take approximately 153 years to reach a steady state level. This steady state level in the pit is 1039 m above mean sea level (AMSL), while the regional groundwater level will be 1045 m AMSL. This is approximately 35 m below ground level. The predicted pit filling rate and level is illustrated in Figure 3.

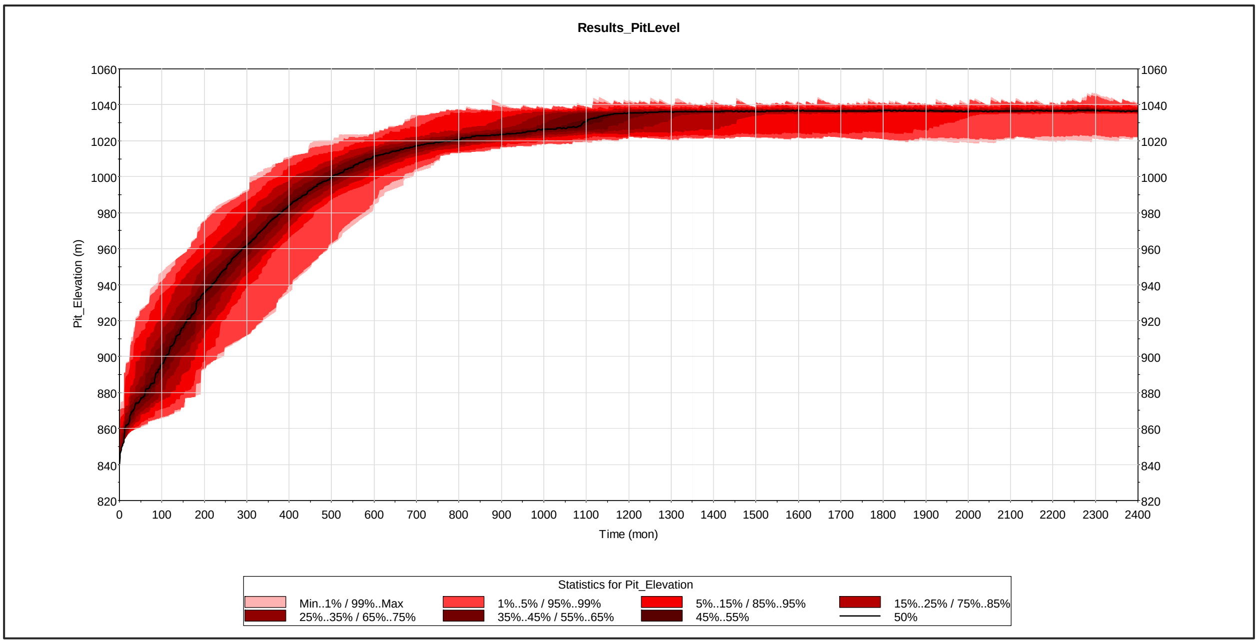


FIGURE 3: PIT FILLING RATE (SLR, JUNE 2019)

3.2.5.6 Pit spilling

The probable maximum precipitation (PMP) is defined as the greatest depth of precipitation for a given duration meteorologically possible for a design watershed. The PMP was used to assess the likelihood of a pit spillage occurring during the most extreme rainfall event. Available rainfall records were used for the analysis and include daily rainfall totals dating back to 1931 providing a total record length of 69 years for PMP analysis. This is deemed sufficient for the purpose as a direct estimation can be made from record lengths of greater than 50 years. The PMP at the mine was estimated to be approximately 470 mm for a 24-h rainfall duration. Modelled results indicated a probability of occurrence of 1 in 10 000 years. It follows that there is no risk of a pit spill from a PMP rainfall event.

3.2.5.7 Water quality

The use of floating wetlands is proposed for the passive treatment of water quality within the pit lake for the following reasons:

- A floating system is relatively easy to implement and the floating wetland area can be increased if required due to changes in water chemistry;
- An area of 2.4ha is required in order to install the floating wetlands as this area provides sufficient depth and coverage for the system to function. Modelled results indicated that it will take 10 years before the floating wetlands can be installed;
- Floating wetland has a positive influence on the chemistry of the pit lake water for other water quality parameters (likely reduction of other key water quality parameters).

The predicted modelling results of water quality of the pit lake with the installation of floating wetlands are tabulated below (Table 3-2). The results of the table indicate that with the installation of floating wetlands the water quality is acceptable for livestock watering and the creation of an aquatic habitat for a minimum of 200 years (the modelled period). It is possible for similar water quality to be achieved beyond the modelled period of 200 years and field trials supplemented with additional modelling are recommended for ongoing design refinement.

TABLE 3-2: PREDICTIVE WATER QUALITY MODELLING RESULTS OF THE PIT LAKE WITH THE INSTALLATION OF FLOATING WETLANDS

Analyse	Livestock DWS	10 Years		50 Years		100 Years		150 Years		200 Years	
Layer		1	2	1	2	1	2	1	2	1	2
Al	5	0.0025	0.0025	0.00035	0.00035	0.0003	0.0003	0.0003	0.0003	0.00038	0.00038
As	1	0.0027	0.00275	0.001	0.001	0.0015	0.0015	0.002	0.002	0.003	0.003
B	5	0.21	0.21	0.64	0.64	0.99	0.99	1.4	1.4	1.85	1.85
Ba		0.093	0.093	0.11	0.11	0.085	0.085	0.066	0.066	0.033	0.033
HCO_3		206	217	232	295	371	279	323	428	377	485
Ca	1000	10	10	93	92	101	101	89	89	66	66
Cd	0.01	0.0005	0.0005	0.0002	0.0002	0.0003	0.0003	0.0004	0.0004	0.0005	0.0005
Cl	1500 3000	69	69	280	280	433	433	596	596	780	780
Cu	0.5	0.0013	0.0013	0.0005	0.0005	0.0007	0.0007	0.0009	0.0009	0.001	0.001

Analyse	Livestock	10 Years		50 Years		100 Years		150 Years		200 Years	
	1.0										
Fe	10	0.026	0.026	0.029	0.029	0.03	0.03	0.03	0.03	0.03	0.03
F	2	0.27	0.27	0.46	0.46	0.69	0.69	0.95	0.95	1.25	1.25
Hg*	0.001	0.0002	0.0002	0.0007	0.0007	0.001	0.001	0.0013	0.0013	0.002	0.002
Mg	500	5.25	5.25	5.7	5.7	8.5	8.5	11	11	15	15
Mn	10	3.1E-05	3.1E-05	1.3-05	1.3E-05	2.2E-05	2.2E-05	2.13-05	2.13E-05	1.5E-05	1.5E-05
Mo	0.01	0.00012	0.00012	0.0025	0.0025	0.004	0.004	0.006	0.006	0.007	0.007
Na	2000	31	31	113	113	177	177	245	245	323	323
NO_3 as N	100	2.97	2.97	1.1	1.1	1.39	1.39	1.8	1.8	2.31	2.31
Ni	1	0.0005	0.0005	0.005	0.005	0.0075	0.0075	0.01	0.01	0.013	0.013
Pb	0.1	0.0018	0.0018	0.014	0.014	0.022	0.022	0.03	0.03	0.04	0.04
pH		8.8	8.07	8.8	7.12	8.8	7.03	8.9	7.05	8.9	7.13
Se	0.05	0.005	0.005	0.003	0.003	0.0044	0.0044	0.006	0.006	0.007	0.007
SO_4	1000	20	20	35	35	54	54	75	75	101	101
TDS	1000 2000 3000	345	356	762	825	1056	1148	1345	1450	1670	1778
V	1	0.19	0.19	0.15	0.15	0.21	0.21	0.28	0.28	0.37	0.37
Zn	20	0.016	0.016	0.013	0.013	0.018	0.018	0.024	0.024	0.037	0.037

* In terms of the mercury (Hg) exceedance parameter after 200 years, it is important to note that the mercury concentration is theoretical because it is not detectable in the groundwater around the site and hence the limit of detection is used in the modelling and, it may therefore never be detectable in the pit lake water over time.

3.2.6 CREATION OF AQUATIC HABITATS

A study was undertaken by Scientific Aquatic Services (SAS, May 2019) to determine the value and applicability of using the end pit lake as a comparative biodiversity support area. In order to understand the potential for aquatic biodiversity in the region an assessment of the aquatic ecology of two analogous systems was undertaken. These two sites were the Kuruman Eye (a natural spring that has been impounded in the centre of the town of Kuruman) and a dam to the south of Kathu, which is augmented by discharge from the Sishen Mine.

The data indicates that a stable and diverse lacustrine community can potentially be supported by a pit lake. Reasonable water quality as well as the presence of productive shallow areas which can support rooted emergent vegetation is, however, deemed essential to create a sustainable ecosystem. The presence of gravel beds will allow some species such as *Oreochrmis mossambicus* and *Labeobarbus aeneus* to successfully spawn and this criterion is considered important in the design of the pit lake.

The conceptual design principles that need to be implemented in order to support an aquatic habitat are summarised in Table 3-3 below.

TABLE 3-3: PIT LAKE CONCEPTUAL DESIGN PRINCIPLES TO SUPPORT AN AQUATIC HABITAT (SAS, MAY 2019)

Design aspect	Detail
Pit lake level	The pit-lake should be developed in such a way as to ensure that the lake is as full as possible without decanting. It also requires surrounding habitat and safe access to ensure that the pit lake is ecologically connected to the surrounding area. This will allow fauna which need to utilise the water safer access to the water source.
Creation of shallows	Since the pit lake water level will rise very slowly, an attempt to ensure the continued availability of shallow habitats as the water level rises is deemed essential. This will ensure that productivity and ecological functioning in the pit lake is maintained as it fills. The benches along with the access road must have habitat created along their lengths and the benches sloped to create this continuity as the water level rises. Shallow areas in a pit lake are of particular importance as the shallower areas provide increased habitat and substrate within the euphotic zone of the lake thereby increasing the productivity of the lake. The need to create shallows is considered essential. Any fairly shallow areas can be brought up to the recommended average depth of 0.6-1m for the euphotic zone through strategic backfilling. It is however recommended to improve efficiency and results that areas of less steep gradient within the pit are targeted.
Creation of gravel beds and scree slopes	An important component of all aquatic ecosystems is cover and habitat for aquatic fauna as well as aquatic vegetation. Smooth bedrock faces and bench bases provide very little habitat and cover for aquatic life. It is therefore important that a variety of microhabitats are created to allow for the establishment and success of a variety of aquatic species. This can be achieved through the creation of gravel beds and scree slopes. In this regard the following applies: • Interstitial spaces of varying sizes need to form part of the scree beds in the shallower portions of the pit lake. Interstitial spaces provide aquatic habitats for macro-invertebrates (eg dragon flies and possible fresh water crabs). Juvenile and small fish species, that are introduced, will also be able to utilise the created small interstitial space for cover while bigger, more mature fish can utilise larger interstitial spaces. This measure will greatly enhance the ecology of the system. The creation of refugia should, where possible, be limited to the portions of the pit-lake which fall within the recommended maximum depth of 4m, to ensure their viability for use by aquatic species. • Brushwood reefs should also be constructed, in order to provide shelter for smaller fish species and ambush cover for larger predatory fish, and in general increase biological complexity, productivity and stability. The use of natural materials for the construction of brushwood reefs prevents the leaching of chemicals into the water and provides a surface for the growth of algae, an important food source for a number of fish species.
Introduction of aquatic vegetation	Vegetation growth within the pit lake needs to be established given that fish species such as *Pseudocrenilabrus philander* and *Tilapia sparrmanii*, prefer habitats with submerged and/or

Design aspect	Detail
	emergent vegetation. Aquatic vegetation may take a number of forms, namely; submerged; floating-leaved (attached); free-floating; and rooted emergent.
Construction of floating wetlands	Floating wetlands are an important component of the project design because they: • Provide microhabitats for macroinvertebrates and cover for small fish as a result of roots growing through the wetland base and into the water; • Provide a food source as a result of debris entering the pit lake; • Provide important ecosystem services, particularly in terms of the assimilation of toxicants and excess nutrients; and • Create micro-habitats and niche habitats for fish, aquatic macro-invertebrates and waterfowl.
Introduction of desirable fish species	Fish are unlikely to rapidly colonise the pit lake through natural processes, especially due to the remote location of the pit in relation to natural perennial water bodies in the area. Although fish may be introduced to the system through dispersal by natural agents such as avifauna it is considered likely to occur very slowly, if at all. It is therefore recommended that desirable fish species are introduced. Recommended fish species include: • Straightfin barb • Longbeard barb • Mozambique Tilapia • Largemouth Yellowfish • Smallmouth Yellowfish • Mosquitofish • Orange river mudfish • Southern mouthbrooder • Banded Tilapia Consideration should be given to introducing the threatened fish species *Labeobarbus kimberleyensis* (Largemouth yellowfish) which is considered to be vulnerable by the IUCN and is endemic to the Vaal-Orange river systems. If the proposed pit-lake can support this species this provides value to fish conservation.

3.2.7 CREATION OF TERRESTRIAL HABITATS

A study was undertaken by Scientific Aquatic Services (SAS, May 2019) in order to understand the terrestrial ecological characteristics required to create terrestrial habitats. In this regard an assessment of two analogous systems was undertaken, namely the Kuruman Eye and the Kathu dam. The Kuruman Eye is a natural waterbody that is recharged from a spring, whilst the Kathu dam is recharged through rainfall as well as the periodic water discharge from Sishen Mine. Both sites provide good insight into the beneficial terrestrial biodiversity that can be achieved around a well-designed and ecologically functional pit lake.

In order for the pit lake to function effectively as part of the greater terrestrial ecosystem the pit lake and surrounding habitat needs to be recreated and rehabilitated to an acceptable degree. This allows for the natural ecological processes to take over and where species diversity, both fauna and flora can naturally increase and self-manage. This is achieved through topography sloping and profiling and topsoil reinstatement, revegetation and creation of faunal habitats. This is discussed in more detail below.

3.2.7.1 Topography and Topsoil Reinstatement

Prior to any rehabilitation activities, a clear plan is required in order to recreate the natural topography in line with the surrounding natural environment as far as possible. In addition to this, the correct reinstatement of topsoil is important to promote vegetation growth. In this regard, the revegetation/landscape plan principles are summarised in Table 3-4 below.

TABLE 3-4: TOPOGRAPHY AND TOPSOIL PLAN PRINCIPLES (SAS, MAY 2019)

Aspect	Detail
Ripping	• All hardened surfaces will be ripped/scarified in order to allow for the increased ingress of moisture as well as the development of floral species root systems; and • Soils must not be ripped to unnecessary depths so as to limit erosion and surface soil runoff during high rainfall events.
Topsoil use	• Topsoil is only to be used for rehabilitation activities and is not to be used for any other processes.
Topsoil depth	• Suitably deep soil is required to allow for vegetation re-establishment. This is required to ensuring effective rooting depths are met; and • In addition, topsoil depths can be varied across the rehabilitated areas in conjunction with the design and planned vegetation cover promoting habitat and topographical diversity. The typical range depending on the type of vegetation ranges between 300 to 600mm.
Sides of the waste rock dump - Netting	• The side slopes of waste rock dumps must be secured through the use of netting or matting to protect the soil surface until suitable vegetation cover has established; • The netting material helps protect the soil from wind and water erosion, and the required rehabilitation plant material can be installed by making small incisions for planting; and • The netting is biodegradable and will eventually break down and form a mulch layer.
Sides of the waste rock dump - sloping	• Slopes should ideally be 1V:3H, and where possible a lesser gradient should be aimed for. All re-shaped to resemble the pre-construction landscape where possible; and • Decreasing the numbers of elevated terrain units where possible. This automatically decreases the risk of surface water runoff, erosion and downslope sedimentation. The revegetation success rate is likely to increase as a result of this, as plant recruitment is less effective on sloped areas due to plants natural susceptibility to rain and wind erosion in newly established landscapes.
Accessibility	• The overall topography to the pit lake must not prohibitive to species movement and access, notably to and from the water edge; and • Incremental terraces should be used towards the pit lake. The terraces should vary in size and slope, thereby creating terrain diversity, a more natural landscape effect and better use of the area for faunal and floral species. Such terrace design combined with the proposed revegetation/landscape plan can be used to efficiently and effectively utilise the available topsoil by creating areas of both deep and shallow soil structures as required by different plant species (effective rooting depths).

3.2.7.2 Revegetation

Revegetation is a process undertaken whereby floral species are established in areas that have previously been cleared, in order to restore and reclaim the lost habitat, ideally to a similar condition of that prior to mining conditions. Habitat restoration processes are often slow, taking decades and the final community of plants may not be the most desirable, notably when unmanaged. It follows that a revegetation plan must be in place in order to avoid such a scenario as far as possible. The revegetation plan principles are summarised in Table 3-5 below.

TABLE 3-5: REVEGETATION PLAN PRINCIPLES (SAS, MAY 2019)

Aspect	Detail
Planting of trees and shrubs	• Revegetation should utilise species that are endemic to the area, including plant species that were rescued as part of a floral rescue and relocation plan; • Plants that have already been relocated to other areas are to remain there and not be removed and replanted again for the revegetation purposes; • In the event that rescued plant species were placed in a nursery environment for future rehabilitation activities, it is important to take note of the following guidelines when using these plants for revegetation: o In the area where replanting is to occur, dig a hole which is slightly larger and deeper than the plant's root structure; o Place the plant in the hole and ensure that it is deep enough that the roots are covered; o When placing the plant in the hole, it is recommended that as far as possible to retain the existing soil around the root structure; o Replace enough soil in the hole to cover the roots and compact the soil to secure the plant in the hole. If necessary, use more soil and compact again; o Make a depression around the plant with a spade such that water will drain towards the plant; o Do not plant the plants in straight lines, but rather randomly as in the natural environment; and o Ensure that planted areas are sufficiently watered in order to ensure their survival, notably in the early phases of germination, but be careful not to overwater the plants as this could lead to the rotting of the roots as well as erosion of the soil surface.
Collective seeding	• Collect seeds from indigenous plant species on site and surrounding natural habitats; • Avoid collection of unripe and underdeveloped seeds as this will lead to unsuccessful germination of the seeds when replanted; • Collected seeds should be dried and placed in paper bags and stored in cardboard boxes in a cool dry area, keeping in mind that the viability of the seeds will reduce with time. It follows that seeds must be collected in the year leading up to the desired re-seeding activity to ensure the maximum viability of the seeds collected; and • Seed collection should be undertaken/overseen by a suitably qualified specialist who is familiar with the various seed types associated with the plant species in the area.
Seeding mix	• An alternative to the manual collection is the use of a seed mix; and • Seed mixes contain a higher species diversity, has been properly collected and stored, is weed free and is likely to have a higher germination rate than that of the collected seeds.
Reseeding timing	• As far as possible reseeding of grass species should occur in the winter months, allowing for seeds to settle into the soil surface and establish prior to the onset of the first rains; • Reseeding should be guided by a rehabilitation specialist who understands the region,

Aspect	Detail
	the vegetation and rainfall patterns; and • Reseeding methods to consider include, manual hand seeding an area or hydro-seeding. These methods are dictated by the site, topography and accessibility of the areas to be reseeded.
Habitat surrounding the pit lake	• The habitat recreated around the pit lake is, should be similar to Kathu Thornveld vegetation type as far as possible; • Revegetation of the banks and immediate landscape adjacent to the pit lake should be done using grass species and small shrubs that are tolerant to fluctuating water levels, so as to ensure continued bank stability; • Riparian zones may be introduced with guidance of a suitably qualified specialist. It is recommended that tree species such as *Vachellia karoo* and *Ziziphus mucronata* be used in patches along the bank to create stability. Further up the bank slopes species such as *Vachellia hebeclada*, *Grewia flava* and *Vachellia haematoxylon* can be incorporated to create small woodland areas; and • The establishment of *Vachellia erioloba* will take an extended period of time as these are slow growing species. It follows that saplings of *Vachellia erioloba* be obtained from a nursery and used during the rehabilitation process. Saplings should be used as this will ensure a higher survivability rate.
Control of alien and invasive species	• The existing alien and invasive species plan should be updated closer to the time of closure in order to facilitate the control in the context of the closure activities; and • The continued implementation and updating of the alien invasive species plan is imperative as these species in general have a higher recruitment rate than indigenous species, notably in disturbed areas.

3.2.7.3 Faunal habitat and Pit Lake

Physical relocation of faunal species as part of the proposed project is not a viable option given that it is costly and requires areas to be fenced off in order to control species movement. Natural relocation and faunal dispersal will be relied upon in order to repopulate the rehabilitated areas, provided the habitat is suitable. In order to create an environment that will support the natural relocation of faunal species the following should be noted:

- The quality of the pit lake water needs to be suitable for animal consumption in the long term. This may be achieved through the establishment of floating wetlands;
- The quality of the pit lake water needs to be suitable to support instream aquatic species in order to ensure that the pit lake functions as a complete ecosystem;
- Accessibility to and through the site must not be hindered. This forms part of the revegetation/landscape plan discussed above; and
- The establishment of alien invasive species must be avoided as this will create undesirable habitats.

A suitable habitat will provide a food resource to attract faunal species, which can be supported by the pit lake as a source of water in a water scare environment. The installation of floating wetlands and the creation of reed beds along the edge of the pit provide a suitable habitat for breeding and foraging for avifaunal species and amphibians. The natural introduction of insects provides a food resource to other faunal species but also is a good indicator of the overall health of the ecosystem through species diversity and abundance. The natural introduction of arachnids provides a good indicator of the overall success to the pit lake activities through the rate of recolonization.

3.2.8 WASTE ROCK DUMPS

3.2.8.1 Waste rock dump design

The current approved EMPr (SLR, August 2017 and April 2019) indicates that waste rock will be utilised to completely backfill the open pit, with some waste rock, albeit limited, remaining on surface post closure due to the bulking factor of broken rock versus in situ rock. As part of the proposed project, the waste rock dumps will remain in perpetuity. These include the northern waste rock dump, eastern waste rock dump, western waste rock dump and the Mamatwan portion 8 waste rock dump as illustrated in Figure 4. The proposed project also allows for earlier planning and execution of waste rock dump rehabilitation, considered preferable to rehabilitation only after complete pit backfilling.

The management of residue stockpiles and deposits must be undertaken in accordance with the Regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits (GNR 632 of 2013) published under the NEM:WA, as well as the complimentary Norms and Standards and other Regulations published under the NEM:WA. In this regard, the design features of the waste rock dumps are presented in Table 3-6 below.

TABLE 3-6: DESIGN FEATURES OF THE WASTE ROCK DUMPS

<table>
<tr><th>Feature</th><th>Detail</th></tr>
<tr><td>Physical dimensions</td><td><table>
<tr><th></th><th>Eastern waste rock dump</th><th>Western waste rock dump</th><th>Mamatwan, portion 8 waste rock dump</th><th>Northern waste rock dump</th></tr>
<tr><td>Area (ha)</td><td>54</td><td>97</td><td>128</td><td>95</td></tr>
<tr><td>Height (m)</td><td>80</td><td>86</td><td>80</td><td>86</td></tr>
<tr><td>Capacity (million m^3)</td><td>19.28</td><td>37.72</td><td>59.12</td><td>45.59</td></tr>
</table></td></tr>
<tr><td>Physical characteristics</td><td>The material comprises rock including sand, calcrete, clay and (uneconomic) banded iron. The water content is expected to be about 5%. The void ratio is approximately 0.5.</td></tr>
<tr><td>Containment of dirty water</td><td>As per the approved EMPr (SLR, August 2017 and April 2019) the separation of clean and dirty water systems at the mine will be designed, implemented, and managed in accordance with the provisions of Regulation 704, 4 June 1999 (Regulation 704) for water management on mines. In this regard, runoff from the waste rock dumps will be collected by means of toe paddocks and will be allowed to evaporate. As part of the proposed project, the toe paddocks will remain post closure until such time as the waste rock dumps have been rehabilitated successfully, after which they can be removed. Refer to Figure 4 for the location of the toe paddocks.</td></tr>
<tr><td>Lining</td><td>No lining is provided for the waste rock dumps. The waste rock dumps will conform to Class D liner specification (Rip and Re-compact).</td></tr>
</table>

Feature	Detail
Side slopes	At closure these waste rock dumps will be shaped to ensure that the areas are free draining and the sides will be sloped as required to allow for the optimal re-establishment of vegetation.
Capping	The waste rock dumps will be capped with a topsoil/growth medium material. Depth of topsoil should be linked to planned vegetation cover as per section 3.2.7.2.
Revegetation	Revegetation to be done in accordance with the revegetation plan included in Section 3.2.7.2.
Rehabilitation success criteria	Rehabilitation success will be determined by monitoring trends in soil nutrient levels, soil microbial levels, vegetation cover and vegetation biodiversity levels and comparing data and temporal trends in the data to numerical targets.

3.2.8.2 Safety classification

The safety classification was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of the MPRDA. The summarised classifications are included in Table 3-7 below.

TABLE 3-7: SAFETY CLASSIFICATION CRITERIA

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard)	There are no farmhouses or other structures within the zone of influence.	Low Hazard
		1 -10 (Medium hazard		
		>10 (High hazard)		
2	No. of Workers in Zone of Influence	<10 (Low hazard)	The eastern and western waste rock dumps are located near the open pit, however no mine workers will be located in the zone of influence as not mining will take place at closure.	Low Hazard
		11 – 100 (Medium hazard)		
		>100 (High hazard)		
3	Value of third-party property in zone of influence	0 – R2 Million (Low hazard)	No formal assessment of the value of property has been done in the zone of influence. Waste rock dump characteristics are such that catastrophic failures will be localised and no extended flow will be experienced.	Low Hazard
		R2 – R20 million (Medium hazard)		
		>R20 million (High hazard)		
4	Depth to underground mine workings	>200 m (Low hazard)	There are no known underground mine workings beneath the waste rock dumps.	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

3.2.8.3 Environmental classification

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

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

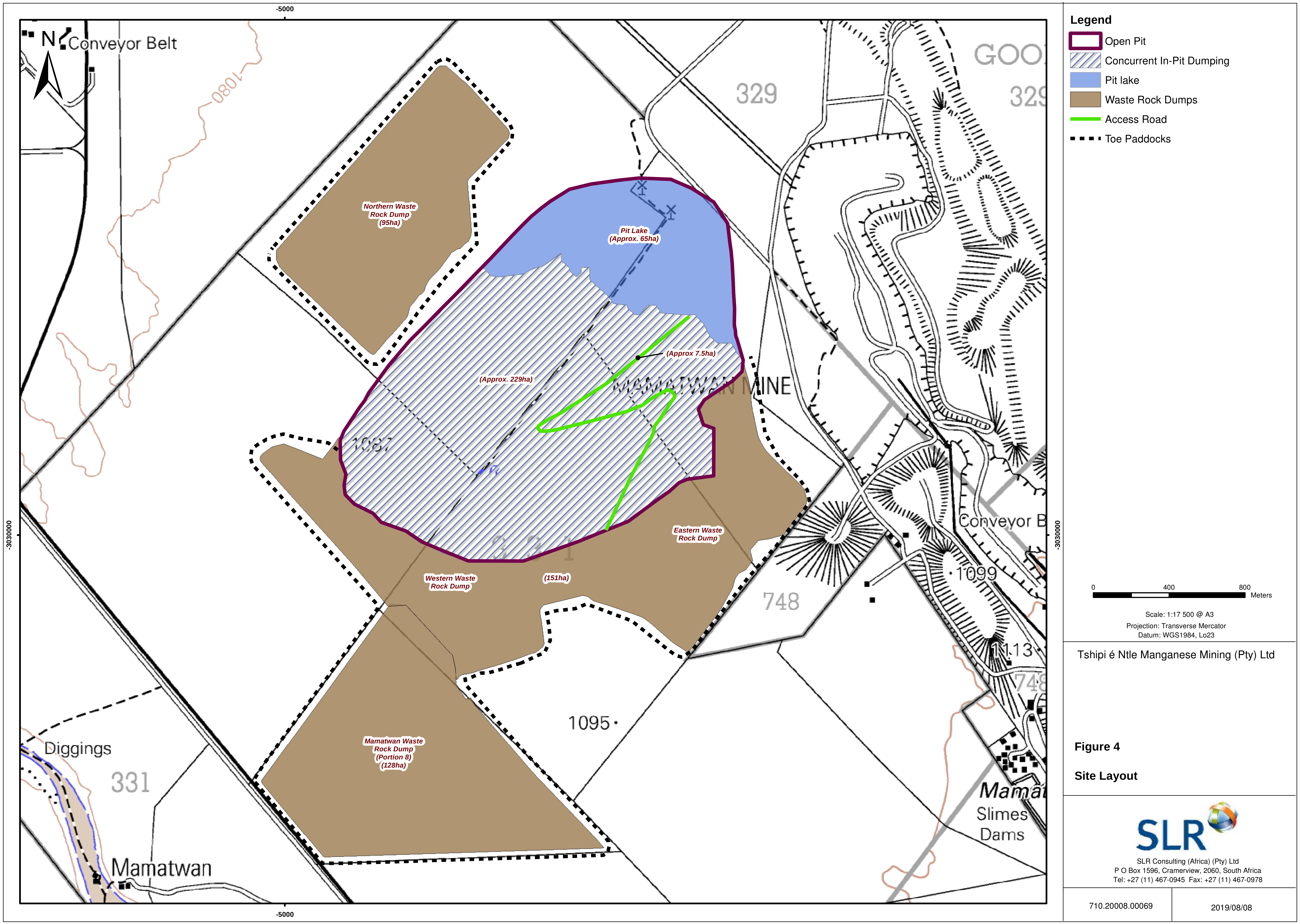
A waste assessment was undertaken by Golder Associates (Golder, 2016) for waste rock generated at the Tshipi Borwa Mine. The preliminary results of the waste assessment indicate that waste rock is classified as a Type 1 waste, which requires a Class A liner, which consists of a compacted clay liner, leachate detection, geotextile membranes and geotextile filters.

In June 2016, the Northern Cape DWS accepted a proposal by the Chamber of Mines of South Africa to follow a risk-based approach on a case-by-case basis to allow for representations on alternative barrier systems for Mine Residue Deposits and Stockpiles when considering water use licence applications (29 June 2016). The risk based assessment enables an evaluation of the efficacy of an alternative barrier system to prevent pollution as required in terms of Section 19(1) and (2) of the NWA (Singh, 2016). In September 2018, GNR 632 was amended to align with the risk-based approach adopted by the DWS. These amendments provide that the applicable pollution control barrier system defined by the Landfill Waste Assessment Norms and Standards and Landfill Disposal Norms and Standards has been removed and is no longer inherently applicable to waste management licence applications for the establishment of residue stockpiles and deposits, and a competent person must now recommend the pollution control measures suitable for a specific residue stockpile or deposit on the basis of a risk analysis undertaken by such competent person as contemplated in GNR 632 (i.e. the old characterisation and classification requirements are still applicable).

Since the purpose of the Norms and Standards is to protect water resources it may be appropriate to consider the potential water quality risk, rather than a formulaic application of the Norms and Standards for the following reasons:

- A Class A liner is impractical for a waste rock dump on the basis of geotechnical properties given that the liner is likely to fail;
- The leachable concentrations of all the constituents are below the LCT0 limit, indicating a low seepage risk;
- The waste rock material will be dry and does not contain waste water; and
- The waste rock material is non-hazardous and not acid generating (Section 7.4.1.1).

Taking the above into consideration Golder recommended, via a formal motivation letter to the DWS, that a Class D liner (stripping topsoil and base preparation) is considered appropriate for the waste rock dumps at the Tshipi Borwa Mine.



-5000
-3030000
Conveyor Belt
N
Northern Waste Rock Dump (95ha)
Pit Lake (Approx. 65ha)
(Approx 7.5ha)
(Approx. 229ha)
MAMATWAN MINE
Eastern Waste Rock Dump
Western Waste Rock Dump
(151ha)
Mamatwan Waste Rock Dump (Portion 8) (128ha)
329
748
1095
1099
1113
331
Diggings
Mamatwan
Slimes Dams
Legend
Open Pit
Concurrent In-Pit Dumping
Pit lake
Waste Rock Dumps
Access Road
Toe Paddocks
0
400
800
Meters
Scale: 1:17 500 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23
Tshipi é Ntle Manganese Mining (Pty) Ltd
Figure 4
Site Layout
SLR
SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978
710.20008.00069
2019/08/08

3.2.9 FUTURE POTENTIAL ADDITIONAL LAND USES – NOT PART OF THE PROPOSED PROJECT

The preceding section (above) provides the sustainable closure land use plan which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock watering.

This section provides additional concepts that could be considered as potential future additional land uses, which could be considered at some point in the future.

3.2.9.1 Aggregate crushing and screening

The proposed project will result in an increase of waste rock dump remaining on surface post closure. Selected waste rock can be used as part of a crushing and screening operation for the production and sale of aggregate post closure. The applicability of this option will however depend on market demands at the time.

3.2.9.2 Aquaponics

The development of a pit lake provides access to water that can be used to promote alternative land uses post closure. As part of the proposed project a soil study was undertaken by Terra Africa (Terra Africa, May 2019) to identify possible alternative land uses. In this regard, the establishment of aquaponics farming units is an identified possibility subject to water quality and availability. Aquaponics is a combination of hydroponics (crops growing in contained spaces where alternative growing media is used and nutrients are provided in the water) and aquaculture (the production of fish and seafood). This system is water efficient (uses 95% to 99% less water than conventional crop production methods) and nutrients are recycled while the water gets filtered by the crop roots. The system is becoming increasingly popular globally as a method to produce both protein and vegetables while using resources optimally.

Aggregate is a popular growth medium used in aquaponics. The waste rock dump at the mine may prove to be a great source of aggregate. Selected waste rock can be crushed in order to be the optimal size for use in aquaponics.

In addition to aquaponics units, some of the existing infrastructure (buildings) can be converted into plant factories. It is a highly efficient system with regards to water use and the crops grow much faster inside the plant factories than other systems. Artificial light is used inside the buildings to allow plants to grow even during the night.

3.2.9.3 Intensive grazing

Water from the pit lake could be used for irrigation of pastures since the soil has suitability for irrigation. The pasture produced can be used for intensive grazing of sheep and/or goats or to set up a feedlot for sheep and goats. It follows that the agricultural enterprises on the land may be diversified and create more employment opportunities. Several secondary businesses can also be developed from these production units (Terra Africa, May 2019).

3.2.9.4 Solar plant

As part of the public participation, a focussed meeting was held with the Northern Cape DAFF. One of the suggestions from the department was to include the possibility of establishing solar plants on the top of existing waste rock dumps. This approach eliminates the need for solar operations to remove protected tree species, which would otherwise need to be removed at green field solar development areas. The energy requirements for some of the above-mentioned land uses, such as aquaponics, could come from solar generation.

3.2.9.5 Use of existing mine buildings for additional land uses

As part of the proposed project, all of the surface infrastructure (except the waste rock dumps) will be removed at closure. There is the possibility of not removing some of the existing infrastructure (eg, buildings), which can be used to support some of the future potential additional land uses discussed above.

4 POLICY AND LEGISLATIVE CONTEXT

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

4.1 LEGISLATION CONSIDERED IN THE PREPARATION OF THE BASIC ASSESSMENT REPORT

4.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998

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

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

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

4.1.2 EIA REGULATIONS 2014

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

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

Listing Notice 1 (see Table 3-1) and therefore a Basic Assessment process is required in order for the Northern Cape DMR to consider the application in terms of NEMA.

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

TABLE 4-1: LEGAL FRAMEWORK

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context?
Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA), as amended	Introduction and Table 4-3	Authorisation is required from the Northern Cape DMR in terms of Section 102 of the MPRDA to amend the existing mine works programme to take cognisance of the proposed project.
National Environmental Management Act No. 107 of 1998) (NEMA), as amended	Introduction, Section 3.1 and Table 4-3	The proposed project incorporates a listed activity in Government Notice Regulation (GNR) 983 (Listing Notice 1; as amended) (refer to Table 3-1). Since the proposed project includes a listed activity in Listing Notice 1, a BAR is required in order for the Northern Cape DMR to consider the application for environmental authorisation.
Regulations 982 of 4 December 2014 (EIA Regulations), as amended		A NEMA environmental authorisation application has been lodged with Northern Cape DMR. In this regard, the environmental authorisation application was submitted on 26 July 2019. A copy of the application is included in Appendix C.
Waste Classification and Management Regulations (GNR 634 of 23 August 2013) with reference to the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR 635 of 23 August 2013) and disposal of waste to landfill (GNR 636 of 2013)	Section 3.2.4	Waste rock stockpiles need to be classified in terms of GNR 632 of the NEM:WA. For the purpose of the proposed project, reference has been made to a waste assessment undertaken by Golder Associates (Golder, 2016) for waste rock generated at the Tshipi Borwa Mine. The results of the waste assessment indicated that a Class D liner is sufficient for waste rock dumps at the mine.
Regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits (GNR 623 of 2015)		
National Water Act (No. 36 of 1998) (NWA), as amended	Section 3.1	There is no specific requirement for Tshipi to obtain a water use licence from the Northern Cape DWS in terms of the NWA for the proposed project. After closure the relevant land user would have to review the need for a water use licence depending on the related future use of the water resource. This may include an abstraction licence to use water from the pit lake.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context?
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA) list of threatened ecosystems (2011)	Section 7.4.1.5	Biodiversity was taken into account as part of project planning and in the assessment of potential impacts.
National Protected Areas Expansion Strategy 2008 (NPAES)		
South Africa Conservation Areas Database (SACAD, 2017)		
South Africa Protected Area Database (SAPAD, 2017)		
Mining and Biodiversity Guidelines (2013)		
Griqualand West Centre of Endemism		
Northern Cape critical biodiversity areas (CBAs) (2016)		
Important Bird Areas (IBA's) (2015)		
According to the NEM:BA, Alien and Invasive Species list of July 2016		
National Forest Act (No. 84 of 1998) (NFA)	Section 7.4.1.5, 9 and 26	The necessary tree removal permits will be obtained from the Northern Cape DAFF in the event that any protected tree species as stipulated under the NFA species need to be removed.
Northern Cape Nature Conservation Act (No. 9 of 2009) (NCNCA)		The necessary plant removal permits will be obtained from DENC in the event that any protected plant species as stipulated under the NCNCA need to be removed.

4.2 GUIDELINES, POLICIES, PLANS AND FRAMEWORKS

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

TABLE 4-2: GUIDELINE AND POLICY FRAMEWORK

Guideline	Governing body	Relevance
Public participation guideline in terms of NEMA (2017)	National Department of Environmental Affairs, Forestry and Fisheries	The purpose of this guideline is to ensure that an adequate public participation process is undertaken during the Basic Assessment process.
Guideline on need and desirability (2017)	National Department of Environmental Affairs, Forestry and Fisheries	This guideline informs the consideration of the need and desirability aspects of the proposed project.

Guideline	Governing body	Relevance
South African Code of Practise for Mine Residue Deposits (SANS: 10286:1998)	National Department of Mineral Resources and Energy	The safety classification of the waste rock dumps were undertaken in accordance with this code of practice.
Joe Morolong Local Municipal Integrated Development Plan 2016	Joe Morolong Local Municipality	The Joe Morolong Local Municipality Integrated Development Plan is the principle strategic instrument guiding all planning, management, investment and development within the province in order to provide best solutions towards sustainable development.
Northern Cape Provincial Spatial Development Framework (NCPSPF, 2012)	Department of Rural Development and Land Reform	The NCPSDF is needed for coherent prioritisation of projects within a spatial economic framework that takes cognises of environmental realities and the imperative to create a developmental state. The NCPSDF was designed as an integrated planning and management tool to facilitate on-going sustainable development through the province.

4.3 LEGISLATIVE BAR CONTENT REQUIREMENTS

This document has been prepared in accordance with the DMR BAR template format, and was informed by the guidelines posted on the official DMR website. This is in accordance with the requirements of the MPRDA. This report also complies with the requirements of the NEMA and regulation 19, read with Appendix 1 and Appendix 4, of EIA Regulations 2014, as amended (GNR 982).

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

TABLE 4-3: STRUCTURE OF THE BAR

BAR requirement as per the DMR template	BAR requirements as per regulation 19 of the 2014 EIA regulations, as amended	Reference in the EMPr report
Part A of DMR report template	**Appendix 1 to the EIA regulations, as amended**	**Section/Appendix**
Details of the EAP.	Details of the EAP who prepared the report.	Section 1.1
Expertise of the EAP.	Details of the expertise of the EAP, including curriculum vitae.	Section 1.2 and Appendix B
Location of overall activity.	The location of the activity, including - the 21 digit Surveyor General code of each cadastral land parcel. Where available the physical address and farm name. Where the required information is not available, the coordinates of the boundary of the property or properties.	Section 2
Locality plan.	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken or on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	Section 2

BAR requirement as per the DMR template	BAR requirements as per regulation 19 of the 2014 EIA regulations, as amended	Reference in the EMPr report
Description of the scope of the proposed overall activity.	A description of the scope of the proposed activity, including all listed and specified activities triggered. A description of the activities to be undertaken, including associated structure and infrastructure.	Section 3
Policy and legislative context.	An identification and description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	Section 4
Need and desirability of the proposed activity.	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location.	Section 5
A motivation of the preferred development footprint within the approved site.	Motivation for the overall preferred site, activities and technology alternative.	Section 5.3
A full description of the process followed to reach the proposed development footprint within the site.	A full description of the process followed to reach the proposed preferred alternative within the approved site.	Section 7
Details of the development footprint alternatives considered.	Details of all the alternatives considered.	Section 7.1
Details of the public participation process followed.	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.	Section 7.2
Summary of issues raised by I&APs.	A summary of the issues raised by I&APs, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	Section 7.3
Environmental attributes associated with the alternatives.	The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	Section 7.4
Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts including the degree of the impacts.	The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed and mitigated.	Section 7.5
Methodology used in determining the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks.	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives.	Section 7.6
The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternative will have on the environment and the community that may be affected.	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	Section 7.7

BAR requirement as per the DMR template	BAR requirements as per regulation 19 of the 2014 EIA regulations, as amended	Reference in the EMPr report
The possible management actions that could be applied and the level of risk.	The possible mitigation measures that could be applied and level of residual risk.	Section 7.8
Motivation where no alternative sites were considered.	The outcome of the site selection matrix. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such.	Section 7.9
Statement motivating the alternative development location within the overall site.	A concluding statement indicating the preferred alternatives, including preferred location of the activity within the approved site.	Section 7.10
Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout) through the life of the activity.	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structure and infrastructure will impose on the preferred location through the life of the activity including a description of all environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Section 8
Assessment of each identified potentially significant impact and risk.	An assessment of each identified potentially significant impact and risk including cumulative impacts, the nature, significant and consequence of the impact and risk, the extent and duration of the impact and risk, the probability of the impact and risk occurring, the degree to which the impact can be reversed, the degree to which the impact and risk may cause irreplaceable loss of a resources and the degree to which the impact and risk can be avoided, managed or mitigated.	Section 9 and Appendix E
Summary of specialist reports.	Where applicable the summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 of these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Section 10
Environmental impact statement.	An environmental impact statement which contains a summary of the key findings of the environmental impact assessment, a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Section 11
Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr.	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr.	Section 12

BAR requirement as per the DMR template	BAR requirements as per regulation 19 of the 2014 EIA regulations, as amended	Reference in the EMPr report
Aspects for inclusion as conditions of authorisation.	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Section 13
Description of any assumptions, uncertainties and gaps in knowledge.	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Section 14
Reasoned opinion as to whether the proposed activity should or should not be authorised.	Reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 15
Period for which environmental authorisation is required.	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	Section 16
Undertaking.	An undertaking under oath or affirmation by the EAP in relation to the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&APs, the inclusion of inputs and recommendations from the specialist reports where relevant and any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs.	Section 17
Financial provision.	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.	Section 18
Specific information required by the competent authority.	Any specific information required by the competent authority.	Section 19
Other matter required in terms of section 24(4)(a) and (b) of the Act.	Any other matter required in terms of section 24(4)(a) and (b) of the Act.	Section 20
Part B of the DMR report template	**Appendix 4 to the EIA regulations**	**Section/Appendix**
Details of EAP.	Details of the EAP who prepared the EMPr and the expertise of that EAP to prepare the EMPr, including curriculum vitae.	Section 21
Description of the aspects of the activity.	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Section 22
Composite map.	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers.	Section 23
Description of impact management objectives including management statements.	A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including planning and design, pre-construction activities,	Section 24
		Section 24.1

BAR requirement as per the DMR template	BAR requirements as per regulation 19 of the 2014 EIA regulations, as amended	Reference in the EMPr report
	construction activities, rehabilitation of the environment after construction and where applicable post closure; and where relevant, operation activities.	
Impacts to be mitigated in their respective phases.	-	Section 24.4
Impact management outcomes.	A description and identification of impact management outcomes required for the aspects contemplated above.	Section 25
Impact management actions.	A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes will be achieved, and must, where applicable, include actions to avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; comply with any prescribed environmental management standards or practices; comply with any applicable provisions of NEMA regarding closure, where applicable and comply with any provisions of NEMA regarding financial provisions for rehabilitation, where applicable.	Section 26
Financial provision.		Section 27
Mechanism for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon.	The method of monitoring the implementation of the impact management actions.	Section 28
	The frequency of monitoring the implementation of the impact management actions.	
	An indication of the persons who will be responsible for the implementation of the impact management actions.	
	The time periods within which the impact management actions must be implemented.	
	The mechanism for monitoring compliance with the impact management actions.	
	A program for reporting on compliance, taking into account the requirements as prescribed by the EIA Regulations.	
Environmental Awareness Plan.	An environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and risks must be dealt with in order to avoid pollution or the degradation of the environment.	Section 29
Specific information required by the competent authority.	Any specific information that may be required by the competent authority.	Section 30
Undertaking.	-	Section 31

This report also complies with the requirements of the NEMA and regulation 19 (5), read with Appendix 5 and of EIA Regulations 2014, as amended (GNR 982) in terms of the content of a closure report. In addition to this, and it terms of Regulation 19(7), the content of the closure plan has been combined with the content the EMPr. Table 4-4 provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

TABLE 4-4: CONTENTS OF A CLOSURE PLAN

NEMA Closure Report Requirements as per Appendix 5 of NEMA Regulations	Reference in the EMPr report
Details of the EAP who prepared the closure plan	Section 1.1
The expertise of that EAP.	Section 1.2
Closure objectives.	Section 27.1.1
Proposed mechanisms for monitoring compliance with and performance assessment against the closure plan and reporting thereon.	Section 28
Measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity and associated closure to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including a handover report, where applicable.	Section 3.2
Information on any proposed avoidance, management and mitigation measures that will be taken to address the environmental impacts resulting from the undertaking of the closure activity.	Section 26
A description of the manner in which it intends to modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation during closure; remedy the cause of pollution or degradation and migration of pollutants during closure; comply with any prescribed environmental management standards or practices; and comply with any applicable provisions of the Act regarding closure.	
The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of closure.	
Time periods within which the measures contemplated in the closure plan must be implemented.	Section 26 and Section 27.1.3
Details of all public participation processes conducted in terms of regulation 41 of the Regulations, including copies of any representations and comments received from registered interested and affected parties; a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; the minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants; where applicable, an indication of the amendments made to the plan as a result of public participation processes conducted in terms of regulation 41 of these Regulations.	Section 7.2
Where applicable, details of any financial provisions for the rehabilitation, closure and on-going post decommissioning management of negative environmental impacts.	Section 18 and 27

5 NEED AND DESIRABILITY OF THE PROJECT

The DEA guideline on need and desirability (GNR 891, 20 October 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. In 2017, the DEA published an updated guideline, although this is yet to be formally gazetted. The 2017 guideline on need and desirability provides that addressing the need and desirability of a development is a way of ensuring sustainable development – in other words, that a development is ecologically sustainable and socially and economically justifiable – and ensuring the simultaneous achievement of the triple bottom-line.

When considering how the development may affect or promote justifiable economic and social development, the relevant spatial plans must be considered, including Municipal Integrated Development Plans (IDP), Spatial Development Frameworks (SDF) and Environmental Management Frameworks (EMF). The assessment reports will need to provide information as to how the development will address the socio-economic impacts of the development, and whether any socio-economic impact resulting from the development impact on people's environmental rights. Considering the need and desirability of a development entails the balancing of these factors. Consistent with the aim and purpose of EIA, the concept of "need and desirability" relates to, amongst others, the nature, scale and location of development being proposed, as well as the wise use of land.

The National Strategy for Sustainable Development and Action Plan 2011 - 2014 (NSSD 1) (2011) states the following:

- In a South African context, sustainability (or a sustainable society) implies ecological sustainability. In the first instance, it recognises that the maintenance of healthy ecosystems and natural resources are preconditions for human wellbeing. In the second instance, it recognises that there are limits to the goods and services that can be provided. In other words, ecological sustainability acknowledges that human beings are part of nature and not a separate entity.
- What is needed and desired for a specific area should primarily be strategically and democratically determined beyond the spatial extent of individual EIAs. The strategic context for informing need and desirability may therefore firstly be addressed and determined during the formulation of the sustainable development vision, goals and objectives of Municipal Integrated Development Plans ("IDPs") and Spatial Development Frameworks ("SDFs") during which collaborative and participative processes play an integral part, and are given effect to, in the democratic processes at local government level.
- When formulating project proposals and when evaluating project specific applications, the strategic context of such applications and the broader societal needs and the public interest should be considered. In an effort to better address these considerations and its associated cumulative impacts, the NEMA also provides for the compilation of information and maps that specify the attributes of the environment in particular geographical areas, including the sensitivity, extent, interrelationship and significance of such attributes which must be taken into account. Whether a proposed activity will be in line with or deviation from the plan, framework or strategy per se is not the issue, but rather the ecological, social and economic impacts that will result because of the alignment or deviation. As such,

the EIA must specifically provide information on these impacts in order to be able to consider the merits of the specific application. Where a proposed activity deviates from a plan, framework or strategy, the burden of proof falls on the applicant (and the Environmental Assessment Practitioner) to show why the impacts associated with the deviation might be justifiable. The need and desirability of development must be measured against the abovementioned contents of the IDP, SDF and EMF for the area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. While project-level EIA decision-making therefore must help us stay on course by finding the alternative that will take us closer to the desired aim/goal, it is through Integrated Development Planning (and the SDF process) that the desired destination is firstly to be considered and the map drawn of how to get there.

5.1 ENSURING ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

Due to the nature of mining projects, impacts on sensitive biodiversity areas, linkages between biodiversity areas and related species, and the role that they play in the ecosystem, are probable. In the absence of appropriate closure planning, these impacts could be permanent. Where closure planning is initiated at an early stage of the mining operations and continues throughout the life of the mine, the principle of a sustainable end state land use can be achieved. The proposed alternative closure and rehabilitation objectives for the mine aim to restore and enhance the ecological integrity of the area by providing improved access to a water resource which would alternatively not be as easily available. The creation of an end pit lake has the potential to provide a unique opportunity to increase aquatic biodiversity in the area, albeit in an artificial way. The creation of the end pit lake would also lead to the creation of niche freshwater related habitats (bank vegetation) for faunal and floral species, whilst also serving as an important water resource for fauna in the region. It is deemed essential that biological interventions such as the development of floating wetlands and the introduction of indigenous fish species take place to speed up the process of food web generation and stabilisation. The rehabilitation of the surrounding mining area through topography landscaping and revegetation will further create habitat for fauna and flora, leading to an increased biodiversity richness of the area. Provided that the proposed project is appropriately designed, managed and implemented it could lead to benefits for both the aquatic and terrestrial environments contributing habitat for protected species of conservation concern and potential Aquifer Dependent Ecosystems as well as improving the ecological integrity of the area. A sustainable post-closure land use has the potential to impact positively on human wellbeing, livelihoods and ecosystem services. The proposed project has to result in positive ecological and biophysical impacts.

The proposed project would also promote earlier rehabilitation of residual waste rock dumps during the operational phase of the mine which supports achieving stable revegetated landscapes. Having waste rock on surface versus backfilled into a pit allows for easier access to this material should it be viable to crush and sell the material as aggregate. In the event that aggregate crushing and removal takes place in future, it supports the reuse of the waste rock material and removal of waste rock from the project site (or the use of aggregate in future aquaponics projects, as mentioned under the future potential additional land uses).

5.2 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

Community/society priorities are officially expressed through public documents including the provincial growth and development strategy and spatial development framework documents. Although provincial growth and development plans mostly focus on municipal priorities over a five-year cycle, they do provide some insight and guidance in terms of future planning for the municipalities. Spatial Development Frameworks (SDFs) which usually have a longer life cycle aim to guide and facilitate the implementation of Integrated Development Plans (IDPs) for the municipality. The vision of the Northern Cape Provincial Growth and Development Strategy and SDF is to build a prosperous, sustainable growing provincial economy to reduce poverty and improve social development. In this regard, the local municipal IDP identifies mining and agriculture as its dominant sectors and further adds that one of the sectors to be further exploited is cattle, goat farming and related activities.

The proposed sustainable closure land use which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock with associated grazing potential would contribute to the agricultural sector post-mining, provided the objectives of the proposed closure plan are met. Positive contributions that support economic benefits from this sector at a local level would contribute towards improving the quality of life for local communities. In addition the IDP and SDF identify the Gamagara Development Corridor as one of the Key Focus Areas for economic growth. Given the mine's location within this corridor, exploring and facilitating the future extraction of mineral resources in a sustainable manner that considers the environment and people, aligns with the objectives of the IDP and SDF. The possibility for longer term employment where the underground resource is further exploited would contribute positively towards maintaining and/or improving the livelihoods of individuals living in the local area. The proposed project supports the potential for a significant net economic gain to the national, regional and local economies by providing relatively simple and cost-effective access to future underground resources.

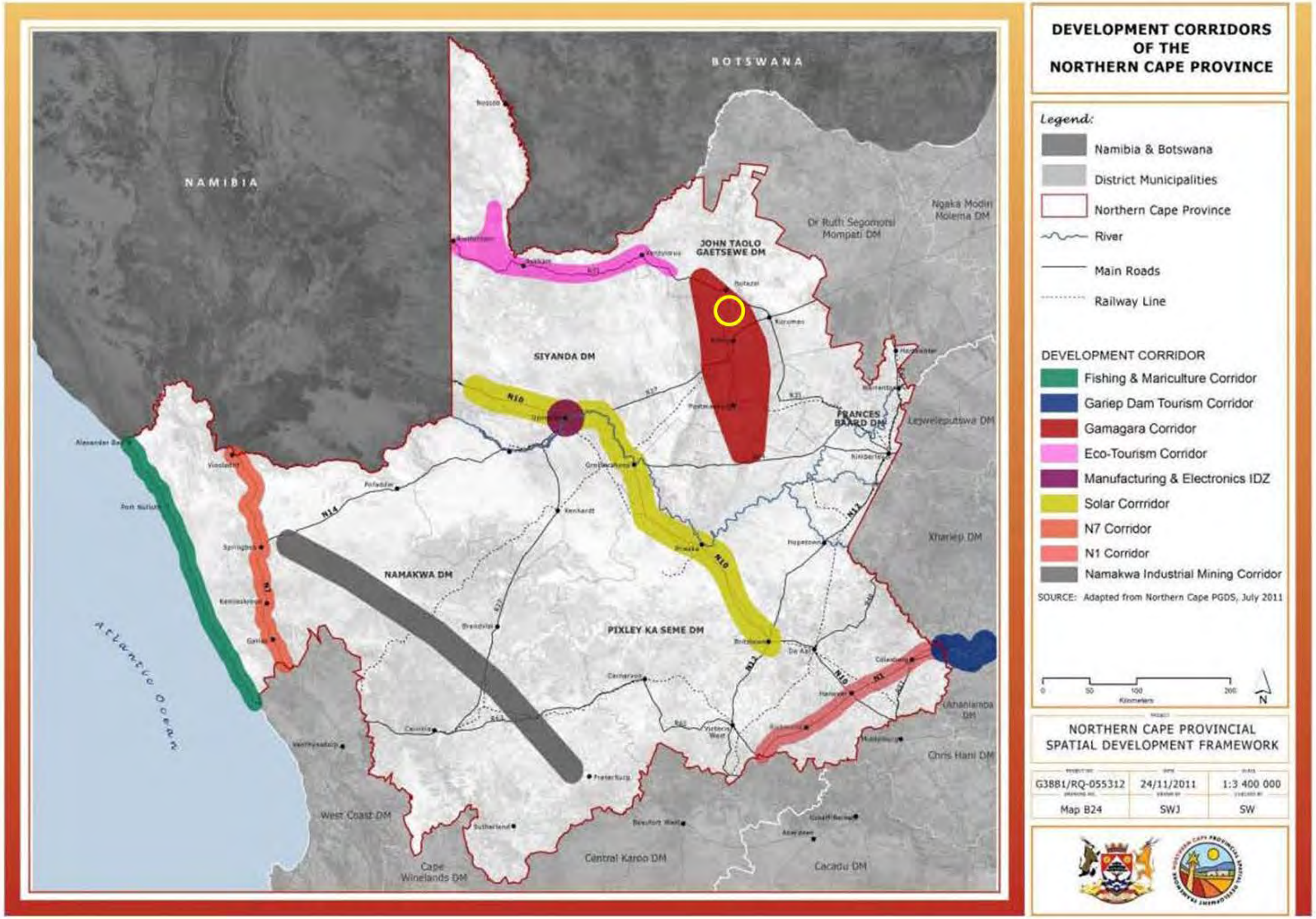


FIGURE 5: MINING RIGHT AREA (YELLOW CIRCLE) IN RELATION TO DEVELOPMENT REGIONS AND CORRIDORS OF THE NORTHERN CAPE (NPSDF, 2012)

5.3 RATIONALE FOR THE PROPOSED PROJECT ACTIVITY

On 17 May 2019, the Minister of Environment, Forestry and Fisheries published the 2nd draft of the 'Proposed Regulations Pertaining to the Financial Provision for the Rehabilitation and Remediation of Environmental Damage caused by Reconnaissance, Prospecting, Exploration, Mining or Production Operations' (2nd Draft Financial Provision Regulations) for comment. The 2nd Draft Financial Provision Regulations seek to entirely replace the NEMA Financial Provisioning Regulations, published on 20 November 2015, as amended (Financial Provisioning Regulations, GNR 1147 of 2015).

The 2nd Draft Financial Provision Regulations focusses on facilitating environmentally sustainable end land uses. In this regard, the following applies:

- The 2nd Draft Financial Provision Regulations highlight that the purpose of setting aside a financial provision is to ensure that operations can achieve an approved sustainable end state at closure;
- Companies have the scope to define a credible sustainable end state in the final rehabilitation, decommissioning and mine closure plan. The sustainable end state must reflect local conditions, regulatory complexities, stakeholder expectations, environmental opportunities and technical solutions for the infrastructure and facilities to support the sustainable end state; and
- The mind shift from classic mine closure (returning the land to its pre-mining state) to focussing on a transitional economy promotes the potential for multiple alternative closure opportunities.

The proposed project offers an alternative closure and rehabilitation strategy to the approved current commitment to re-instate the environment to that of grazing and/or wilderness potential in order to align the Tshipi closure objectives with the sustainable end state focus of the 2nd Draft Financial Provision Regulations. It follows that the proposed closure land use objective is to create a sustainable closure land use which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock with associated grazing potential.

6 MOTIVATION FOR THE PREFERRED SITE, ACTIVITIES AND TECHNOLOGY ALTERNATIVES

Refer to Section 7.1 for further detail.

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

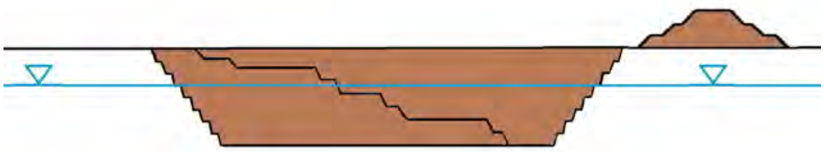
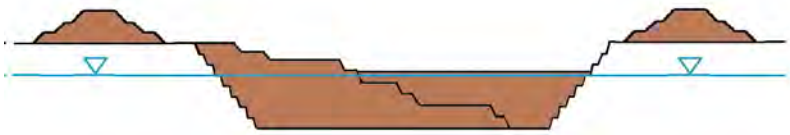
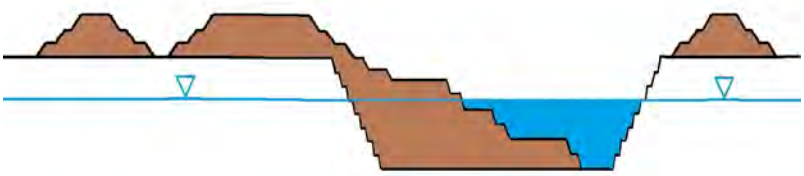
7.1 DETAILS OF THE DEVELOPMENT FOOTPRINT CONSIDERED

7.1.1 ALTERNATIVES CONSIDERED AND PREFERRED OPTION

The approved EMPr commits Tshipi to restore the surface to pre-mining state of wilderness and grazing and requires that the open pit is completely backfilled. Recent optimisation investigations indicate that when considering environmental, socio-economic, legal, commercial and technical, factors, completely backfilling the open pit is sub-optimal. This section describes alternatives that were considered as part of the proposed project and not proceeding with the proposed project. Project alternatives that were considered included: complete backfill (option 1), partial backfill (option 2), concurrent backfill only (in-pit dumping) (option 3) and no backfill (option 4) (Table 7-1).

The alternatives analysis has indicated that concurrent backfill only (in-pit dumping) is the optimal option from an environmental, socio-economic, technical, legal and commercial perspective. A summary of the impacts and risk associated with the four alternatives is included in Section 7.5. The detailed alternatives assessment matrix, outlining the advantages and disadvantages of the alternatives is included in Section 7.7.

TABLE 7-1: PROJECT ALTERNATIVES THAT WERE CONSIDERED

Options considered	Illustration	Detail
Complete backfill (option 1)		Backfill of the final pit void post mining to original ground level, before rehabilitation of the surface as per the current approved EMPr.
Partial backfill (option 2)		Backfill of the final pit void post mining to a level just above the rebound water-table level, approximately 50m below original ground level, before rehabilitation of the surface.
Concurrent backfill only (in-pit dumping) (option 3)		Backfill of the pit void concurrent with mining only, also called in-pit dumping, which results in a partial void and associated pit lake which will be 'made safe' (profiled) before rehabilitation of the surface.

Options considered	Illustration	Detail
No backfill (option 4)		No backfill of the pit either concurrent with mining or post mining i.e. all waste rock to surface dumps. The pit side-walls and end-walls will only be 'made safe'. The entire pit becomes a pit lake.

7.1.2 THE "NO-GO" ALTERNATIVE

The assessment of this option requires a comparison between the options of proceeding with the proposed project with that of not proceeding with the proposed project. Proceeding with the project attracts potential economic benefits (future underground resources) and promotes the use of alternative land uses post closure with the aim of aligning closure objectives with that of the sustainable end state focus of the 2nd Draft Financial Provision Regulations. Not proceeding with the project means that the pit will be completely backfilled and rehabilitated to an end state of grazing/wilderness and as such the economic spin-offs and biodiversity enhancements will not be realised.

7.2 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

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

7.2.1 PUBLIC PARTICIPATION PROCESS UNDERTAKEN

A public participation process was undertaken to inform the Basic Assessment process. A record of the public participation process undertaken is outlined in Table 7-2 below. The purpose of the public participation process was to notify landowners, land users and other key stakeholders of the proposed project and to provide them with opportunity to raise any initial issues or concerns regarding the proposed project.

TABLE 7-2: PUBLIC PARTICIPATION PROCESS UNDERTAKEN AS PART OF THE BAR

Step	Detail
Pre-application and application phase	
Northern Cape DMR Pre-application meeting	A pre-application meeting was held with the Northern Cape DMR in Kimberly on 02 May 2019. The purpose of the meeting was: • To provide information pertaining to the proposed project; • To outline the motivation for the proposed project; • To outline the alternatives considered as part of the proposed project; • To provide an overview of the environmental process relevant to the project; • To outline the specialist studies to be undertaken for the proposed project; and • To outline and obtain input on the planned public participation process. A copy of the pre-application meeting minutes including the signed attendance register is included in Appendix D.
Environmental authorisation application	The NEMA environmental authorisation application was submitted to the Northern Cape DMR on 26 July 2019. Refer to Appendix C for a copy of the application form and the acknowledgement by the Northern Cape DMR.
Notification of commenting authorities and I&APs	
Notification of the land claims commissioner	The Northern Cape Department of Rural Development and Land Reform has indicated no land claims have been lodged on the farms Moab 700 and Mamatwan 331. The proof of correspondence is attached in Appendix D.
Update of I&AP database	The project I&APs database was updated by: • Verification of the relevant surrounding landowners, land occupiers, relevant ward councillor, municipalities, organs of state, commenting authorities and other I&APs; • Verifying contact details for I&APs on the existing database; and • Verifying appropriate communication structures.

Step	Detail
Background Information Document (BID)	A BID was compiled by SLR and distributed via email and hand deliveries in July 2019 to I&APs and commenting authorities registered on the project database. The BID provided: • Information about the proposed project; • Information about the baseline environment of the proposed project area; • Information about the environmental assessment process (Basic Assessment Process); • Information regarding possible environmental and socio-economic impacts; • Details pertaining to the public meeting; and • Information on how I&APs and commenting authorities can have input into the environmental assessment process. A registration and response form was attached to the BID, which provided I&APs with an opportunity to register as an I&AP and submit comments on the proposed project. Copies of the BID in English and Afrikaans are included in Appendix D.
Site notices	SLR placed laminated site notices (in English and Afrikaans) at key conspicuous positions in and around the Tshipi Borwa Mine, as well as in nearby towns. Photographic proof is included in Appendix D. A map illustrating the location of the site notices is also included in Appendix D.
Newspaper advertisements	Block advertisements were placed in the Kalahari Bulletin and the Kathu Gazette on 15 June 2019 and 13 June 2019 respectively. Copies of the adverts are included in Appendix D.
Project meetings	
General public and commenting authorities meeting	A (poorly attended) general public and commenting authorities meeting was held on 26 June 2019. The purpose of the meeting was as follows: • To provide an overview of the proposed project; • To outline the motivation and alternatives of the proposed project; • To provide an overview of the environmental assessment process (Basic Assessment); • To provide an overview and obtain input on the existing status of the environment; • To outline and obtain input on environmental and socio-economic impacts identified with input from specialists (where relevant); and • To record any comments and issues raised. These issues and concerns will be used to inform the BAR. Copies of the meeting minutes including the signed attendance register are included in Appendix D.
Focussed commenting authorities meeting with the Department of Water and Sanitation (DWS) and the Department of Agriculture, Forestry and Fisheries (DAFF)	Focussed commenting authorities meetings were held with the DWS on 21 June 2019 and with DAFF and DENC on 27 June 2019 respectively. The purpose of the meeting was as follows: • To provide an overview of the proposed project; • To outline the motivation and alternatives of the proposed project; • To provide an overview of the environmental assessment process (Basic Assessment); • To provide an overview and obtain input on the existing status of the environment; • To outline and obtain input on environmental and socio-economic impacts identified with input from specialists (where relevant); and • To record any comments and issues raised. These issues and concerns will be used to inform the BAR.

Step	Detail
	Copies of the meeting minutes including the signed attendance register are included in Appendix D.
Review of the BAR	
Public review and commenting authority Review of BAR	The BAR was made available for public review and comment for 30 days. Summaries of the BAR were made available to all I&APs registered on the I&AP database via email, fax and post. In addition, I&APs were notified when the BAR was available for review via SMS. In addition to this, electronic copies were made available on the SLR website. Commenting authorities either received an electronic copy or a hard copy of the BAR depending on the commenting authorities' preference. A summary of the BAR availability in both English and Afrikaans was prepared by SLR and distributed to all I&APs and commenting authorities registered on the project database. For a copy of the summary and proof of distribution refer to Appendix D. Refer to Appendix D for the proof of distribution of the BAR for public and commeing authority review.
Following review of the BAR	The BAR has been updated to include all comments received during the review and commenting period and responses thereto. This updated report is now available to the Northern Cape DMR for decision making purposes.
Notifying registered I&APs of DMRE's decision	Within 14 days of the date of the Northern Cape DMR's decision, all registered I&APs will be notified of the outcome of the application, the reasons for the decision and the manner in which they can access the decision; and draw their attention to the fact that an appeal may be lodged against the decision in terms of the National Appeal Regulations.

7.3 SUMMARY OF ISSUES RAISED BY I&APS

A summary of the issues and concerns raised by I&APs, regulatory authorities and commenting authorities as part of the public participation process are tabulated below. Issues and concerns raised following the review of the BAR by I&APs and commenting authorities is included in blue text in the table below.

TABLE 7-3: SUMMARY OF ISSUES RAISED BY I&APS

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Regulatory authority				
Northern Cape Department of Mineral Resources (DMR)				
Ntsundeni Ravhugoni	Comments raised at the pre-application meeting with the DMR on 02 May 2019	Can the open pit be backfilled after the underground mining is completed? This approach can be considered as an alternative to changing the backfill commitment.	Practically the final void could be backfilled after the deeper resource is mined out however; • Firstly, when considering environmental, socio-economic, technical, commercial and legal factors, completely backfilling the open pit is sub-optimal as a closure solution and an alternative closure and rehabilitation strategy offers; opportunities for enhanced biodiversity habitats and access to surface water; • Secondly, this would imply that the surface waste rock dumps would remain as (un-rehabilitated) temporary dumps until after closure of the underground mine, possibly as long as 70 years from now whereas with concurrent backfill only, rehabilitation of surface waste rock dumps can commence almost immediately; and • Lastly, the underground mine is marginal and if the attributable closure liability is included in the underground	Not applicable.

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Ntsundeni Ravhugoni	Comments raised at the pre-application meeting with the DMR on 02 May 2019		mine business plan then the business case may no longer be attractive. i.e. the deeper (underground) resource will be sterilised.	
		As part of the alternative investigation, please also comment on the level of Tshipi's responsibility for the four closure options. Our department is of the opinion that with complete backfill, Tshipi's overall responsibility will be less than a closure option where biodiversity habitats are created that need to be maintained and monitored. As an overall comment, we will wait for the final Environmental Impact Assessment (EIA) and EMPr for the details around the specialist findings of the alternative investigation.	A discussion on the positive and negative impacts of each of the alternatives considered is included in Section 7.7. In this regard, it is important to note that there will be a closure phase monitoring and aftercare obligation in both the complete backfill (option 1) and concurrent backfill only (in-pit dumping) (being the preferred option) (option 3) scenarios. In terms of completely backfilling, the long term focus would be groundwater monitoring with shorter term monitoring and aftercare plan aspects focussed on groundwater levels, vegetation/ecosystem establishment, and erosion prevention. In terms of concurrent (in-pit dumping), the long term focus would be on the pit lake where field implementation and monitoring is required to determine how successful the floating wetlands will be as a semi passive treatment solution. Moreover, ongoing monitoring, wetland maintenance/replacement, and establishment of shallow ecosystems may be required in the longer term to maintain the pit lake quality for livestock and ecology use. Alternatively, if the water quality fails at some point then alternative treatment technologies may need to be considered or the use of the pit lake and access thereto may have to change. The shorter term monitoring and aftercare plan aspects focussed on groundwater levels, vegetation/ecosystem establishment, and erosion prevention.	Section 7.7 (alternatives discussion)

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			Taking the above into consideration, post closure monitoring and aftercare maintenance is more extensive (more aspects that require monitoring) and the duration of the post closure obligations increases from the preferred concurrent (in-pit dumping) alternative when compared to completely backfilling. It is however important to note that the level of responsibility is only one aspect that was considered in the alternatives analysis as outlined in Section 7.5. In this regard when all environmental, social, technical (inclusive of level of responsibility), legal and commercial factors are considered as a whole, the preferred option is concurrent (in-pit dumping). Further to this, not proceeding with the project means that the pit will be completely backfilled and rehabilitated to an end state of grazing/wilderness and as such the economic spin-offs and biodiversity enhancements will not be realised.	
Commenting authorities				
Northern Cape Department of Water and Sanitation				
Fhatuwani Magonono	Comments raised at a focussed meeting held on 21 June 2019	An application has recently been submitted to our department for amendments to the existing Integrated Water Use Licence Application for Tshipi. Will the application associated with this proposed project form part of the amendment that is currently with the department for processing, or will a separate application be	As part of the proposed project, the waste rock dumps that will remain on surface and backfilling the open pit are water uses in terms of Section 21(g) of the NWA for the disposal of waste in a manner that my detrimentally impact on water resources. These water uses either form part of the existing WUL or are incorporated into the IWUL amendment application that is currently with your department for processing. Even though these facilities/activities	Section 3.1 (listed and specified activities)

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Fhatuwani Magonono	Comments raised at a focussed meeting held on 21 June 2019	made?	are associated with the proposed project, these water uses form part of the current mining operations which require authorisation. It follows, that there is no specific requirement for Tshipi to obtain a water use licence from the Northern Cape DWS in terms of the NWA for the proposed project. After closure the relevant land user would have to review the need for a water use licence depending on the related future use of the water resource. This may include an abstraction licence to use water from the pit lake.	
		The Northern Cape Department of Water and Sanitation will need to authorise the use of waste rock to backfill the open pit in terms of Section 21(g) of the National Water Act (No. 36 of 1998).		
		Is the backfilling authorised by the Northern Cape Department of Mineral Resources?	Tshipi is currently required to completely backfill their open pit in accordance with their approved EMPr's (SLR, August 2017 and SLR, April 2019). Prior to the commencement of the proposed project, authorisation will be required from the Northern Cape DMR to change the approved backfill commitment to concurrent backfilling only (in-pit dumping).	Introduction
		Why create a pit lake? Why don't you completely rehabilitate the whole pit?	As part of the proposed project, the aim is to create a sustainable closure land use which is a combination of natural habitats creation (aquatic and terrestrial) and livestock watering with associated grazing potential. This can be achieved through access to water within the pit lake. If the pit is completely backfilled, it will not be possible to create a pit lake and the biodiversity enhancements will not be realised. It is important to note, that additional concepts could be considered at some point as potential future additional land uses that may require the use of water within the pit lake. With reference to Section 3.2.9, these include aggregate crushing and screening,	• Section 3.2.1 (project description) • Section 3.2.9 (potential additional land uses)
		What will be the use of that water?		

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Fhatuwani Magonono	Comments raised at a focussed meeting held on 21 June 2019		aquaponics and intensive grazing. These additional land uses are not specifically assessed as part of the proposed project as these are potential land uses that can be considered.	
		The pit lake water will be contaminated because of the waste rock dumps? It will end up infiltrating to the groundwater.	As part of the proposed project, independent hydrologist, geohydrologist and geochemists were appointed to understand the impacts associated with the development of a pit lake. In this regard, specialist investigations have shown that without passive treatment water quality within the pit lake will be suitable for livestock watering purposes for up to 100 years but thereafter some form of floating wetland treatment will be required. Specialists have therefore recommended the use of floating wetlands for the passive treatment of water quality within the pit lake. The predicted modelling results of water quality of the pit lake with the installation of floating wetlands indicate that the water quality is acceptable for livestock watering and the creation of an aquatic habitat for a minimum of 200 years (the modelled period). It is possible for similar water quality to be achieved beyond the modelled period of 200 years and field trials supplemented with additional modelling are recommended for ongoing design refinement. In addition to the above, the impact associated with groundwater contamination was assessed as part of the proposed project. In this regard the pit lake will act as a sink because the pit lake level will settle below the relevant groundwater level. This means that groundwater water will flow towards the pit lake and not from the pit lake outwards. Predicated modelling results indicated that no impacts on any off-site third party boreholes are expected.	• Section 3.2.5.7 (pit lake water quality) • Appendix E (impact assessment

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Fhatuwani Magonono	Comments raised at a focussed meeting held on 21 June 2019	Please ensure that post closure monitoring is undertaken?	A post closure monitoring programme has been developed for the proposed project and is outlined in Section 28 of this report.	Section 28 (monitoring programme)
		Will the pit spill?	The pit lake level will settle approximately 35m below ground level. It follows that there is no risk of a pit spill.	Section 3.2.5.6 (pit lake development)
		Did you conduct a waste classification study?	Waste assessments have been conducted for the Tshipi Borwa Mine as part of previous projects. In this regard, waste assessments were undertaken in accordance with Regulation 5 of GNR 632 of the NEM:WA, which states that waste rock stockpiles need to be classified taking into account Regulation 8 of GNR 634 of 2013, which references the following associated National Norms and Standards: • The National Norms and Standards for the assessment of waste for landfill disposal (GNR 635 of 2013); and • The National Norms and Standards for disposal of waste to landfill (GNR 636 of 2013). A waste assessment was undertaken by Golder Associates (Golder, 2016) for waste rock generated at the Tshipi Borwa Mine. The preliminary results of the waste assessment indicate that waste rock is classified as a Type 1 waste, which requires a Class A liner, which consists of a compacted clay liner, leachate detection, geotextile membranes and geotextile filters. In June 2016, the DHSWS accepted a proposal by the Chamber of Mines of South Africa to follow a risk based approach on a case-by-case basis to allow for representations on alternative barrier systems for Mine Residue Deposits and Stockpiles (29 June 2016).	Section 3.2.8.3 (Environmental classification)

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Fhatuwani Magonono	Comments raised at a focussed meeting held on 21 June 2019		Golder recommended, via a formal motivation letter to the DHSWS, that a Class D liner (stripping topsoil and base preparation) is considered appropriate for the proposed waste rock dumps at the Tshipi Borwa Mine for the following reasons: • A Class A liner is impractical for a waste rock dump on the basis of geotechnical properties given that the liner is likely to fail; • The leachable concentrations of all the constituents are below the LCT0 limit, indicating a low seepage risk; • The waste rock material will be dry and does not contain waste water; and • The waste rock material is non-hazardous and not acid generating.	
		The most critical part in terms of this application will be the geohydrological report, which must cover the modelling of the plume and the monitoring boreholes (post closure monitoring) both near and downstream.	Groundwater modelling has been undertaken for Tshipi. This modelling makes provision for a worse case theoretical scenario which includes a completely backfilled open pit with all waste rock dumps remaining on surface. This allows for multiple pollution sources and re-establishment of close to normal groundwater flow. In reality, the proposed closure option will include the partially backfilled pit acting as a hydraulic sink with a draw down cone toward the pit lake in perpetuity. The reason for using the conservative theoretical modelling scenario is the precautionary principle which is relevant because of the importance of understanding groundwater risk in this particular arid region. Details pertaining to the groundwater model are included in the Pit lake report included in Appendix H. A detailed discussion of the groundwater impacts and contamination plume modelling results are provided in Appendix E.	• Appendix E (detailed impact discussion with pollution plume modelling results) • Appendix H (pit lake report) • Section 28 (monitoring programme)

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
			A post closure monitoring programme has been developed for the proposed project and is outlined in Section 28 of this report.	
Department of Environmental and Nature Conservation and Department of Environment, Forestry and Fisheries				
Jacoline Mans- DAFF	Comment raised at focus meeting held on 27 June 2019	Will the water from the pit-lake be clean, will it not be contaminated?	As part of the proposed project, independent hydrologist, geohydrologist and geochemists were appointed to understand the impacts associated with the development of a pit lake. In this regard, specialist investigations have shown that without passive treatment water quality within the pit lake will be suitable for livestock watering purposes for up to 100 years for up to 100 years but thereafter some form of floating wetland treatment will be required. Specialists have therefore recommended the use of floating wetlands for the passive treatment of water quality within the pit lake. The predicted modelling results of water quality of the pit lake with the installation of floating wetlands indicate that the water quality is acceptable for livestock watering and the creation of an aquatic habitat for a minimum of 200 years (the modelled period). It is possible for similar water quality to be achieved beyond the modelled period of 200 years and field trials supplemented with additional modelling are recommended for ongoing design refinement.	Section 3.2.5.7 (pit lake water quality)
		In terms of protected trees and plants, how will the footprint differ from what's currently authorised? Will your dumps not increase in terms of surface area? Will they not have an impact on currently undisturbed areas?	The rehabilitation of the waste rock dumps will include shaping to ensure that the areas are free draining and the sides will be sloped as required to allow for the optimal re-establishment of vegetation. It is possible that as part of sloping the waste rock dumps, that some current undisturbed areas may be influenced. It is important to note that Tshipi is still committed to implement management actions as	• Appendix E (detailed impact assessment and management actions) • Section 3.2.7.2

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Jacoline Mans- DAFF	Comment raised at focus meeting held on 27 June 2019		outlined in the approved EMPr's (SLR, August 2017 and April 2019). It follows that if any protected trees or plant species need to be removed as part of rehabilitating the waste rock dumps, the necessary tree and/or plant removal permits will be obtained from DAFF and/or DENC. Moreover, refer to Section 3.2.7.2 for the revegetation plan which aims to re-establish key habitats and related trees.	(revegetation plan)
		So your current waste rock dumps are not rehabilitated?	The current approved EMPr requires that Tshipi backfills the open pit completely. In this scenario, given that waste rock would be backfilled into the open pit, no waste rock dumps that are currently on surface are therefore rehabilitated. Once the waste rock is backfilled into the open pit, surface rehabilitation would commence. As part of the proposed project, some waste rock will remain on surface in perpetuity. It follows that the proposed project will allow for the earlier rehabilitation of waste rock dumps as part of on-going operations, which will improve the state of rehabilitation at closure.	Section 3.2.8 (waste rock dump design)
		In terms of alternative land use on the permanent dumps, is it not possible to invite solar plant companies to place their solar panels on the permanent dumps instead of disturbing the natural veld next to the mine?	As part of the proposed project, the aim is to create a sustainable closure land use which is a combination of natural habitats creation (aquatic and terrestrial) and livestock watering with associated grazing potential. Additional concepts could be considered at some point as potential future additional land uses. With reference to Section 3.2.9.4, provision has been made for the consideration of establishing solar plants on the top of existing waste rock dumps.	Section 3.2.9.4 (future additional land uses)
		In terms of your existing Environmental Authorisation, was there not something about	The existing environmental authorisations held by Tshipi do not specifically indicate that a biodiversity offset is required. The	Appendix E (detailed impact assessment and

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Jacoline Mans- DAFF	Comment raised at focus meeting held on 27 June 2019	offsets that Tshipi had to do? Is a biodiversity offset not already a condition in the Environmental Authorisation?	approved EMPrs (SLR, August 2017 and April 2019) however indicated that Tshipi is committed to implement an offset when required by DAFF.	management actions)
		But there's a sign that reads "Tshipi biodiversity offset area", I'm not sure whether it's still there?	Tshipi is aware of the sign that you are referring to. This sign should not have been erected and plans are being made to remove the sign. No offset area has been identified yet.	Not applicable
Samantha De la Fontaine- DENC		Is it possible for you to send DAFF and DENC the offset investigation report?	Tshipi will ensure that this is done.	Not applicable
Jacoline Mans- DAFF		Please send DAFF and DENC an electronic copy (CD) of the BAR?	This was done. Please refer to Appendix D for the proof of distribution.	Not applicable
South African Heritage Resource Agency				
Natasha Higgit- SAHRA	Comments received from SAHRIS website on 30 July 2019	As the proposed development is undergoing an EA Application process in terms of the National Environmental Management Act, 107 of 1998 (NEMA), NEMA Environmental Impact Assessment (EIA) Regulations for activities that trigger the Mineral and Petroleum Resources Development Act, No 28 of 2002 (MPRDA)(As amended), it is incumbent on the developer to ensure that a Heritage Impact Assessment (HIA) is done as per section 38(3) and 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). This usually includes an archaeological component, palaeontological component and	As part of the proposed project, a heritage specialist was consulted. In this regard, the specialist confirmed that no heritage resources are present at the Tshipi Borwa mine and the proposed project will not impact heritage resources. In terms of palaeontological resources, the specialist confirmed that there is a low possibility of palaeontological resources occurring in the project area. It is however important to note that in the event on any chance finds, the SAHRA will be notified and where necessary permits need to be obtained prior to disturbance as outlined in Section 26. A copy of the heritage specialist exemption letter is included in Appendix N. As part of the proposed project, a heritage specialist was consulted.	• Appendix N (exemption letter) • Section 26 (management actions)

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Natasha Higgit- SAHRA	Comments received from SAHRIS website on 30 July 2019	any other applicable heritage components. The HIA must be conducted as part of the EA Application in terms of NEMA and the NEMA EIA Regulations.	In this regard, the specialist confirmed that no heritage resources are present at the Tshipi Borwa mine and the proposed project will not impact heritage resources. In terms of palaeontological resources, the specialist confirmed that there is a low possibility of palaeontological resources occurring in the project area. It is however important to note that in the event on any chance finds, the SAHRA will be notified and where necessary permits need to be obtained prior to disturbance as outlined in Section 26. A copy of the heritage specialist exemption letter is included in Appendix N.	
		As the proposed development area is highly disturbed, the assessment to the impact of heritage may be reduced to a Letter of Recommendation of Exemption for further heritage studies in order to comply with section 38(8) of the NHRA. See www.asapa.co.za or www.aphp.org.za for specialists who will be able to provide such a report. The letter is referred to in the SAHRA 2007 Minimum Standards: Archaeological and Palaeontological Component of Impact Assessments.		
		The proposed development area is located within an area of moderate sensitivity as per the SAHRIS PalaeoSensitivity map. The BID notes that stromatolites may be present in the area. A desktop Palaeontological Impact Assessment must be undertaken to assess whether or not the development will impact upon palaeontological resources (please see https://www.palaeosa.org/heritage-practitioners.html for a list of palaeontological practitioners). The PIA must comply with the SAHRA 2012 Minimum Standards:		

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Natasha Higgit- SAHRA	Comments received from SAHRIS website on 30 July 2019	Palaeontological Component of Heritage Impact Assessments. The appointed palaeontologist may also choose to submit a Letter of Recommendation for Exemption as noted in the 2012 Minimum Standards.	As part of the proposed project, a heritage specialist was consulted. In this regard, the specialist confirmed that no heritage resources are present at the Tshipi Borwa mine and the proposed project will not impact heritage resources. In terms of palaeontological resources, the specialist confirmed that there is a low possibility of palaeontological resources occurring in the project area. It is however important to note that in the event on any chance finds, the SAHRA will be notified and where necessary permits need to be obtained prior to disturbance as outlined in Section 26. A copy of the heritage specialist exemption letter is included in Appendix N.	
		Any other heritage resources as defined in section 3 of the NHRA that may be impacted, such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed.		
		The draft BAR and appendices must be submitted at the start of the public review process so that an informed comment can be issued.	This was done. Please refer to Appendix D for the proof of upload.	Not applicable
Natasha Higgit – SAHRA	Comments received on SAHRIS on 16 September 2019	A Final Basic Assessment Report (FBAR) has been submitted in terms of the National Environmental Management Act, no 107 of 1998 (NEMA), NEMA EIA Regulations for activities that trigger the Mineral and Petroleum Resources Development Act, No 28 of 2002 (MPRDA)(As amended). The proposed closure includes the backfilling of the open pit and sloping and rehabilitation of the waste rock dumps.	In terms of palaeontological resources, there is a low possibility of palaeontological resources occurring in the project area. In order to address the request by SAHRA, a Letter of Exemption as per the 2012 Minimum Standards: Palaeontological Component of Heritage Impact Assessments be provided by a qualified palaeontologist is included in Appendix N.	Appendix N (exemption letter)

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Natasha Higgit – SAHRA	Comments received on SAHRIS on 16 September 2019	PGS Heritage has been appointed to provide specialist heritage input as part of the EA as per section 38(3) and section 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) as required by section 24(4)b(iii) of NEMA. Fourie, W. Recommendation for Exemption from Heritage and Palaeontological Impact Studies: Environmental Authorisation (EA) and Closure and Rehabilitation Optimisation Project at the Tshipi Borwa Mine, near Hotazel, Northern Cape Province-Case ID: 13996. The letter concludes that no heritage resources were present within the proposed development area and that the proposed activities will not impact heritage resources. The letter noted that stromatolites might be present in the mining area however that the activities would not lead to detrimental impact to the palaeontological resources. As per the Interim Comment issued on the 30/07/2019, SAHRA requested that a Letter of Exemption as per the 2012 Minimum Standards: Palaeontological Component of Heritage Impact Assessments be provided by a qualified palaeontologist. SAHRA awaits this requested document before further comments are issued.		

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Interested and Affected Party				
Moses Moalani (Care for Nature, NGO)	Comment raised at public meeting held on 26 June 2019	Is Tshipi using its own water or is it sourcing water from The Vaal Gamagara? Do you access water from boreholes?	Tshipi currently sources water from the Vaal Gamagara Water Supply pipeline. Tshipi has recently submitted a water use licence application to the DWS to authorise the abstraction of groundwater from boreholes located at the Tshipi Borwa Mine. This application is still pending. This would be in addition to the Vaal Gamagarra water	Not applicable
		Do you intend on rehabilitating the open pit?	Yes. Rehabilitation of the pit is planned to ensure that a sustainable closure end land use which is a combination of natural habitats creation (aquatic and terrestrial) and livestock watering with associated grazing potential is achieved.	Section 3.2.1 (project description)
		Is the license for closure only for this portion (open pit)?	The closure licence would be for the entire area that currently falls within the Tshipi surface use area.	Figure 4 (surface use area)
		Will there be another public meeting?	There is no plan on holding another meeting unless this is specifically requested by I&APs.	Not applicable
		Were department officials invited to this public meeting? Were landowners made aware of the meeting too?	As part of the proposed project a public involvement database is developed. This database includes landowners, surrounding landowners, land users, ward councillors, commenting authorities, decision making authorities, industries, surrounding mining operations and NGO's. Everyone included on the database was notified about the proposed project and were provided with the details of the public and commenting authorities meeting. A copy of the public involvement database and proof of notifying I&APs of the public and commenting authorities meeting are included in Appendix D.	• Section 7.2 (details of public participation followed) • Appendix D (public involvement database and proof of distribution)

Interested and affected party	Date comment received	Issues raised	Response provided	Section and paragraph reference in this report where the issues and or responses were incorporated
Moses Moalani (Care for Nature, NGO)	Comment raised at public meeting held on 26 June 2019		Focussed meetings were arranged with the DWS, DAFF and DENC as key commenting authorities. Copies of these focussed meeting minutes are included in Appendix D. Issues and concerns raised during the focussed meetings by DWS, DAFF and DENC are included in this issues table.	
		How do you monitor air quality?	A dustfall monitoring network is in place at Tshipi Borwa Mine. In this regard, monitoring results indicate that mining and surrounding activities and infrastructure contribute towards sources of emissions such as dust fallout and PM10 that occasionally exceed relevant NAAQS and NDCR limits.	• Section 7.4.1.8 (baseline monitoring results) • Section 28 (location of monitoring points)

7.4 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES

An understanding of the existing environmental and social context and sensitivity within which mining activities are currently located is important to understanding the potential impacts at closure. This section provides a description of the attributes of the biophysical and socio-economic receiving environment at the mine.

It is important to note that the section below provides a description of the baseline environment within the context of existing approved infrastructure (SLR, August 2017 and SLR, April 2019). This baseline environment contextualises the environmental attributes associated with the alternatives identified above, i.e. complete backfill (option 1), partial backfill (option 2), concurrent backfill only (in-pit dumping) (option 3) and no backfill (option 4). It is important to note, that the existing environmental attributes discussed below, are unlikely to differ between the various alternatives considered.

7.4.1 BASELINE ENVIRONMENT AFFECTED BY THE PROPOSED ACTIVITY

7.4.1.1 Geology

INTRODUCTION AND LINK TO IMPACT

Geology and associated structural features provide a basis from which to understand:

- The potential for sterilisation of mineral reserves;
- The geochemistry and related potential for the pollution of water from waste rock dumps; and
- The potential for geological lineaments such as faults and dykes. Faults, dykes and other lineaments can act as preferential flow paths of groundwater, which can influence the dispersion of potential pollution plumes from waste rock dumps.

Geological processes also influence soils forms (see Section 7.4.1.4) and the potential for palaeontological resources (see Section 7.4.1.11).

DATA SOURCES

Information in this section was sourced from the approved EMPr (SLR, August 2017).

Regional and local geology information was sourced through the review of available literature. Geochemical analysis was undertaken to determine the potential for acid mine drainage and the potential leachate from waste rock stockpiled on surface at the Tshipi Borwa Mine. Samples of different lithologies were taken from the waste rock stockpiles.

DESCRIPTION

Regional geology

The world's largest land based sedimentary manganese deposit is contained in the Kalahari Manganese Field, situated 47 km north-west of Kuruman in the Northern Cape. The general stratigraphic column of the Kalahari Manganese Field is included in Table 7-4 below. The Kalahari Manganese Field comprises five erosional, or structurally preserved, relics of the manganese bearing Hotazel Formation of the Paleoproterozoic Transvaal Supergroup. These include the Mamatwan-Wessels deposit (also known as the main Kalahari Basin), the Avontuur and Leinster deposits, and the Hotazel and Langdon Annex/Devon deposits. The Tshipi Borwa Mine is located in the Hotazel Formation (Transvaal Supergroup) towards the southern end of the Kalahari Basin. The Hotazel Formation typically consists of repeated thin layers of black iron oxides (magnetite or hematite) alternating with bands of iron-poor shales and cherts – the so called banded iron formations.

TABLE 7-4: GENERAL STRATIGRAPHIC COLUMN FOR THE KALAHARI MANGANESE FIELD (SLR, AUGUST 2017)

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

Local and operational geology

The Hotazel Formation is underlain by basaltic lava of the Ongeluk Formation (Transvaal Supergroup) and directly overlain by dolomite of the Mooidraai Formation (Transvaal Supergroup) as shown in Table 7-4.

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

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

Tshipi is exploiting the manganese from the banded iron stones of the Hotazel Formation. The ore is contained within a 30 to 45 m thick mineralised zone which occurs along the entire extent of Tshipi and is made up of three manganese rich zones, namely the Upper Manganese Ore Body (UMO), the Middle Manganese Ore Body (MMO) and the Lower Manganese Ore Body (LMO) (see Table 7-4). The UMO is 10 cm to 15 cm thick and comprises moderate deposits of manganese. The poorly mineralised MMO is approximately 1 m thick and not economically viable. The LMO is highly mineralised and makes up the bulk of the ore body. The ore layer dips gradually to the north-west at approximately five degrees. This implies that the mineral resources extend down gradient (north-west) of the planned open pit mining operations.

Faults and dykes

No significant faults, fractures or other lineaments have been identified on site.

Geochemistry – Acid Base Accounting

Acid base accounting (ABA) is undertaken to determine the potential for material to generate acid mine drainage. Samples were analysed to determine if waste rock is likely to generate acid mine drainage. The results are presented in Table 7-5 below.

The ABA results (Table 7-5) show that the total sulphur content and more importantly the sulphide sulphur content of all samples are below the laboratory detection limit of <0.01% which suggests the potential to generated acid is negligible for waste rock. In addition, the neutralising potential ratio (NPR) of all samples is above 2, with some significantly above 2, which implies all lithologies have sufficient neutralising potential to offset the low acid potential. This is interpreted to be due to carbonate minerals, as suggested by the generally high inorganic carbon in the samples and the carbonate-rich geology (calcretes, dolomites, etc.).

TABLE 7-5: ACID BASE ACCOUNTING RESULTS FOR THE WASTE ROCK DUMPS (SLR, AUGUST 2017)

Lithology	Elevation (mamsl)	Paste pH	Acid Potential (AP)(kg/t)	Neutralization Potential (NP)	Net Neutralisation Potential (NP)	Neutralising Potential Ratio (NPR) (NP:AP)	NAG pH: (H_2O_2)	NAG (kg H_2SO_4/t)	Total Sulphur (%)	Sulphate Sulphur as S (%)	Sulphide Sulphur (%)	Total Carbon (%)	Organic Carbon (%)	Inorganic Carbon (%)
Braunie Lutite	1021.922	8	0.313	280	280	897	8.4	<0.01	<0.01	<0.01	<0.01	5.6	0.172	5.428
Upper BIF	1020.801	8.5	0.313	66	66	213	8.3	<0.01	<0.01	<0.01	<0.01	0.86	0.208	0.652
Upper BIF	1018.252	8.4	0.313	13	13	41	8.8	<0.01	<0.01	<0.01	<0.01	0.148	0.13	0.018
Lower BIF – red in colour	1018.919	8.4	0.313	130	130	417	8.5	<0.01	<0.01	<0.01	<0.01	4.09	0.202	3.888
Pebble bed in calcareous clay	1026.990	8.3	0.313	4.26	3.95	14	8.2	<0.01	<0.01	<0.01	<0.01	0.07	0.069	0.001
Pebble bed in red calcareous clay	1030.217	8.5	0.313	323	323	1034	8.3	<0.01	<0.01	<0.01	<0.01	7.8	0.258	7.542
Red clay	1031.184	8.2	0.313	51	51	163	8.8	<0.01	<0.01	<0.01	<0.01	3.34	0.257	3.083
Lower BIF	1012.341	8.7	0.313	100	100	322	8.5	<0.01	<0.01	<0.01	<0.01	3.38	0.119	3.261
Red clay	1030.098	8.2	0.313	74	73	236	8.8	<0.01	<0.01	<0.01	<0.01	1.28	0.247	1.033
White clay	1052.157	8.1	0.313	5	4.69	16	7.7	<0.01	<0.01	<0.01	<0.01	0.335	0.331	0.004
White gravel bed	1054.877	8.6	0.313	5.75	5.43	18	7.8	<0.01	<0.01	<0.01	<0.01	0.278	0.273	0.005
Red Iron Calcareous Sand	1066.225	8.3	0.313	110	109	351	8.5	<0.01	<0.01	<0.01	<0.01	2.5	0.361	2.139
Pebbly Calcrete	1067.984	8.5	0.313	79	79	254	8.4	<0.01	<0.01	<0.01	<0.01	2.01	0.203	1.807
Iron rich Calcareous Sand	1067.131	8.4	0.313	106	106	339	8.5	<0.01	<0.01	<0.01	<0.01	2.76	0.272	2.488
Pebbly Calcrete	1072.483	8.5	0.313	106	105	338	8.5	<0.01	<0.01	<0.01	<0.01	5.41	0.275	5.135
Red Kalahari Sands	1088.848	8.1	0.313	2.73	2.41	8.72	7.7	<0.01	<0.01	<0.01	<0.01	026	0.255	0.005
Calcrete	1081.302	8.5	0.313	146	146	467	8.5	<0.01	<0.01	<0.01	<0.01	4.48	0.356	4.124
Pebbly Calcrete	1075.395	8.7	0.313	113	113	361	8.3	<0.01	<0.01	<0.01	<0.01	3.32	0.314	3.006
Dolomite	998.00	8.7	0.313	115	114	367	8.4	<0.01	<0.01	<0.01	<0.01	11.48	0.148	11.33

Geochemistry analysis – leachate

Synthetic Precipitation Leaching Procedure (SPLP) was used to determine the potential drainage quality from the sampled lithologies at the Tshipi Borwa Mine at neutral (pH7) drainage conditions. The results are provided in Table 7-6 below. The results indicated that some metals are leachable at concentrations in excess of relevant water quality standards for waste rock. These include:

- Aluminium (Al) in terms of the SANS 241 (2105) Operational standards;
- Iron (Fe) in terms of the SANS 241 (2015) Aesthetic standards; and
- Manganese (Mn) in terms of the SANS 241 (2015) Aesthetic standards.

TABLE 7-6: LEACHATE RESULTS FOR WASTE ROCK (SLR, AUGUST 2017)

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

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

CONCLUSION

The approved EMPr (SLR, August 2017), commits Tshipi to completely backfilling the open pit at closure and as such is likely to make access to the backfilled waste rock resource difficult. Given that manganese mineral resource continues to dip down gradient of the planned open pit rehabilitation and closure planning should also consider access to / sterilisation of future mineable resources. The sterilisation and/or loss of mineral resources has the potential to present a negative net economic impact on the national, local and regional economy. Geochemical analysis indicates that the potential to generate acid is negligible. Leachate at source could exceed the SANS 241 (2015) drinking water standards for certain contaminants, and this presents a potential pollution risk for both surface and groundwater post closure.

7.4.1.2 Topography

INTRODUCTION AND LINK TO IMPACT

Changes to topography may impact on surface water drainage (Section 7.4.1.6) and visual aspects (Section 7.4.1.10) through the presence of final land forms (waste rock dumps) and the safety of both third parties and animals through the presence of surface waste rock dumps and the partially open pit with a pit lake. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

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

DESCRIPTION

In general the area surrounding the Tshipi Borwa Mine is relatively flat with a gentle slope towards the North West. The elevation varies from 1087 m to 1107 m above mean sea level (mamsl). The Vlermuisleegte River is located approximately 2km west from the Tshipi Borwa Mine boundary. The natural topography of the area surrounding the Tshipi Borwa Mine has been influenced through the presence of isolated farmsteads and mining activities such as the Mamatwan Mine, the old Middelplaats Mine and the United Manganese of Kalahari Mine (see section 7.4.2 for further information). The highest topographical features near the Tshipi Borwa Mine are the Mamatwan waste rock dumps located adjacent to the eastern boundary of the Tshipi Borwa Mine (Figure 2).

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

CONCLUSION

The natural topography has already been altered by existing infrastructure at the Tshipi Borwa Mine. At closure the natural topography will be permanently altered through the presence of waste rock dumps remaining in perpetuity and a partially open pit with a pit lake which may pose a safety risk to third parties and animals in the absence of rehabilitation.

7.4.1.3 Climate

INTRODUCTION AND LINK TO IMPACT

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

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

DATA SOURCES

Information in this section was sourced from the approved EMPr (SLR, August 2017), the pit lake study compiled for the proposed project (SLR, June 2019) included in Appendix H and the air quality study (Airshed, June 2019) included in Appendix I.

Rainfall data utilised for this project is provided by the South African Weather Service (SLR, June 2019) for the period 1931 to 2018. Evaporation rates were sourced from Agricultural Resources Council. Temperature and wind field data was sourced from the South African Weather service for the period 2015 to 2017.

DESCRIPTION

Regional climate

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

Rainfall, evaporation and rainfall depths

Monthly rainfall and evaporation data for the Milner weather station (approximately 7 km to the east of the Tshipi Borwa Mine) is illustrated in Figure 6 (SLR, June 2019). From the figure below, it is important to note that the monthly average evaporation rates are several times greater than rainfall.

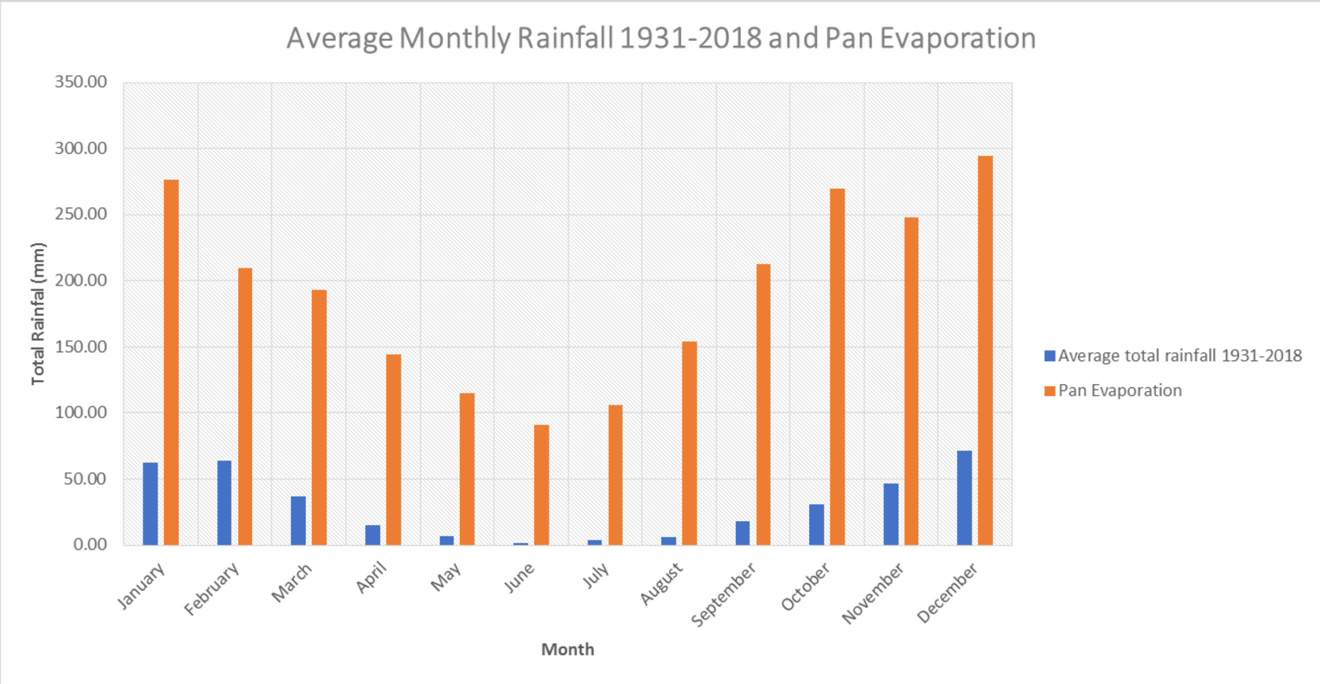


FIGURE 6: AVERAGE MONTHLY RAINFALL AND EVAPORATION DATA (SLR, JUNE 2019)

The available rainfall record was analysed to determine the annual maximum 24 hour rainfall depth (Figure 7). The mean of the annual maximum 24 hour rainfall series was calculated to be approximately 52. The probable maximum precipitation at the Tshipi Borwa Mine is approximately 470 mm for a 24 hour rainfall duration.

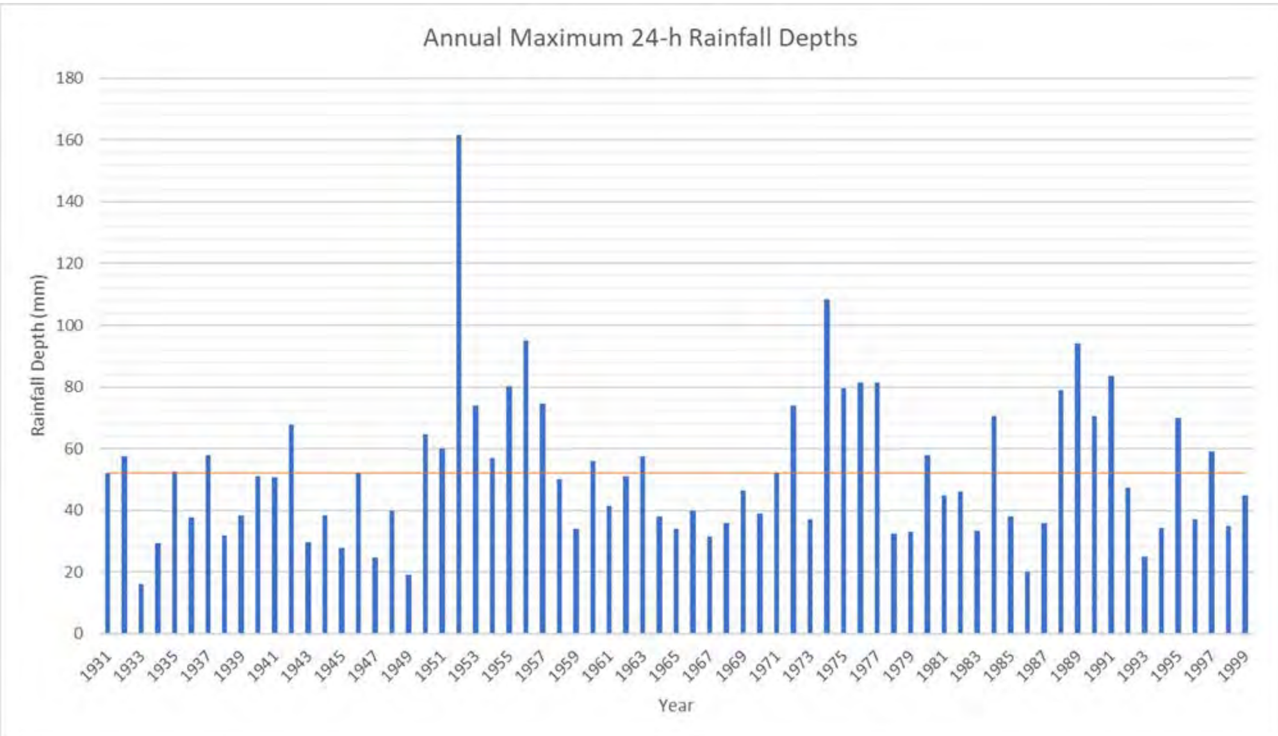


FIGURE 7: DAILY ANNUAL MAXIMUM RAINFALL DEPTHS FOR ANALYSED RAINFALL (SLR, JUNE 2019)

Temperature

The area generally experiences hot summers and cold winters. The monthly temperature pattern is provided in Table 7-7 below. In this regard, the average daily maximum temperatures range between 43°C in January to 25°C in June, with daily minima between -4.2°C in August to 10°C in January.

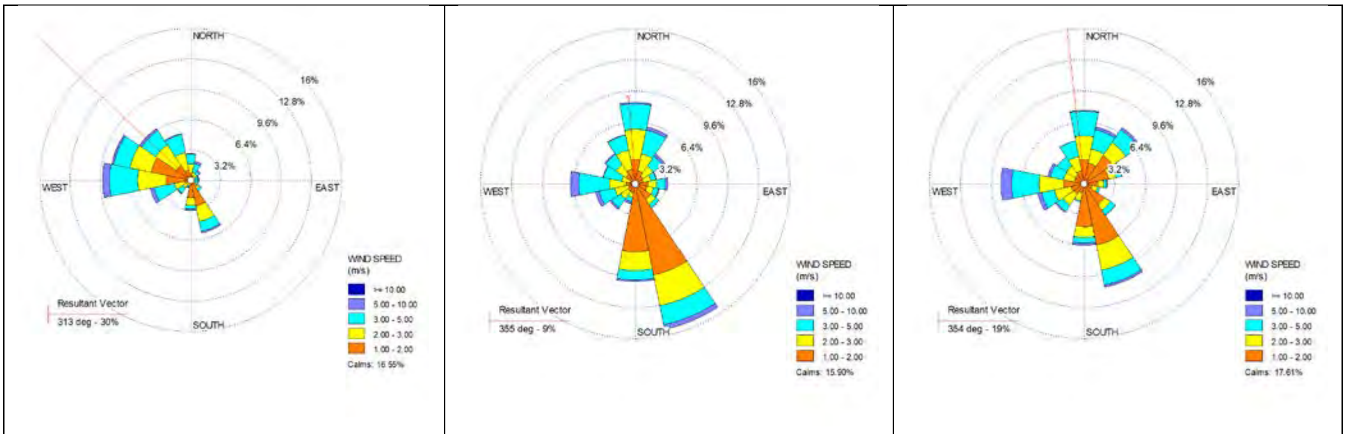
TABLE 7-7: MINIMUM, AVERAGE AND MAXIMUM TEMPERATURES (AIRSHED, JUNE 2019)

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Min	10.1	10	6.4	3.3	2	-3.2	-3.9	-4.2	2.2	2.7	4.3	9.6
Ave	25.1	24.3	22.2	17.9	14.0	10.7	10.8	13.8	18.5	21.7	23.5	26.4
Max	42.6	38.8	35.6	35.3	28.8	25.3	27.1	31.3	34.7	38.5	39.5	39.9

Wind

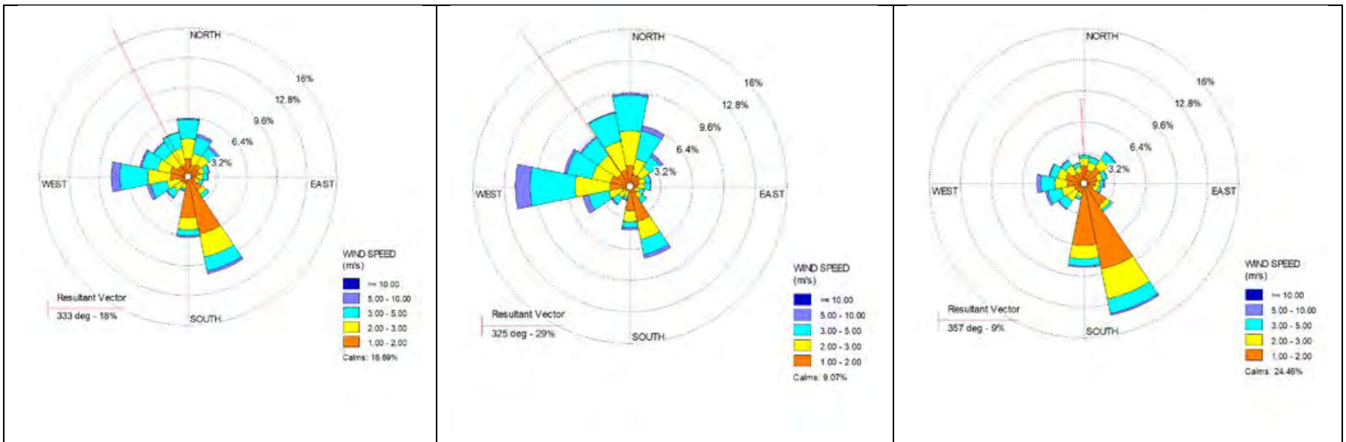
The annual average wind roses for the Kuruman Weather Station (located approximately 43 km to the west of mine) for the years 2015, 2016 and 2017 are shown in Figure 8 with the period average wind field (2015-2017) and diurnal variability in the wind field provided in Figure 9. The predominant wind direction is from the south-south-east and south with most of strong winds from the west. Frequent winds also occur from the north. Over the three-year period (2015 – 2017), the frequency of occurrence of south-south-easterly wind was between 12% and 17%, with winds with a westerly component occurring approximately 15% of the time. Winds occur less frequently from the easterly sector (Airshed, June 2019). During the day winds are more frequent from the westerly and the northerly sectors, with the strongest winds directly from the west (see Figure 9). The wind shifts during the night-time to dominantly south-south-easterly and southerly winds. Day-time calms occurred for 9% of the time, with night-time calms for 24% of the time (Airshed, June 2019).

According to the Beaufort wind force scale, wind speeds between 6-8 m/s equates to a moderate breeze, with wind speeds between 14-17 m/s near gale force winds. Based on the three years of SAWS data (2015-2017), wind speeds exceeding 6 m/s occurred for only 1% of the time, with a maximum wind speed of 10 m/s. The average wind speed over the three years was 2.06 m/s. Calm conditions (wind speeds < 1 m/s) occurred for 17% of the time. The US EPA indicates a friction velocity of 5.4 m/s to initiate erosion from a coal storage piles (US EPA, 2006). Thus, the likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. Wind speeds exceeding 5.4 m/s occurred only for 2% over the three years (2015 -2017) (Airshed, June 2019).



Annual Wind Rose 2015 | Annual Wind Rose 2016 | Period Wind Rose 2015-2017

FIGURE 8: PERIOD AND ANNUAL WIND ROSES (AIRSHED, JUNE 2019)



Period | Day-time | Night-time

FIGURE 9: PERIOD, DAY-TIME AND NIGH-TIME WIND ROSES (AIRSHED, JUNE 2019)

Atmospheric Stability

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

For low level releases, such as activities associated with mining operations, the highest ground level concentrations would occur during weak wind speeds and stable (night-time) atmospheric conditions. However, windblown dust is likely to occur under high winds (neutral conditions) (Airshed, June 2019).

CONCLUSION

The project area is characterised by hot to very hot summers and cool to warm winters with rain generally occurring in the form of localised thunderstorms that last for short periods at a time during rainy periods (October to April). High evaporation rates reduce infiltration, while rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does, however, reduce the effects of erosion. The mixing of layers resulting in the formation of temperature inversions, and the presence of cloud cover limits the dispersion of pollutants. Wind significantly affects the amount of material that is suspended from exposed surface and wind speed determines the distance of downward transport as well as the rate of dilution of pollutants in the atmosphere. The likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. These climatic aspects need to be taken into consideration during closure planning.

7.4.1.4 Soils and land capability

INTRODUCTION AND LINK TO IMPACT

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

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

DATA SOURCES

Information in this section was sourced from the approved EMPr (SLR, June 2019) and the soil and land capability study (Terra Africa, June 2019) undertaken for the proposed project included in Appendix F.

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

DESCRIPTION

Soil forms

The soil form associated with the Tshipi Borwa Mine is Hutton. The Hutton soil form comprises the following characteristics:

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

Soil chemical characteristics

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

Dry land agriculture potential

This province mainly has a semi-arid to arid climate where drought spells frequently occurs. Although large areas of the Kalahari region consist of deep apedal red and yellow soil profiles that are considered ideal for crop production in other parts of the country, the low rainfall in the area makes cattle and game farming the only viable agricultural options.

Irrigation potential

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

CONCLUSION

The soil form (hutton) located at the Tshipi Borwa Mine is well-drained sandy soil, which allows for high infiltration rates and low organic content and is highly erodible. The soil fertility is low due to a deficiency in key nutrients, such as phosphorus. In general, the soil form located in the Tshipi Borwa Mine has limited agricultural potential due to low rainfall. Existing infrastructure of the mine has influenced the natural capability of the land. Soil is a valuable resource that supports a variety of ecological functions and is key to re-establishing post closure land capability. It follows that Tshipi will require appropriate management actions to prevent the loss of soil resources through pollution and erosion as soil resources form a crucial role during rehabilitation.

7.4.1.5 Biodiversity

INTRODUCTION AND LINK TO IMPACT

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known value of biodiversity and ecosystems relate to soil formation and fertility maintenance; primary production through photosynthesis; provision of food and fuel; provision of shelter and building materials; regulation of water flows and water quality; regulation and purification of atmospheric gases; moderation of climate and weather; control of pests and diseases; and maintenance of genetic resources.

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

DATA SOURCES

Information in this section was sourced from the approved EMPr’s (SLR, August 2017 and SLR, April 2019) and the biodiversity study compiled for the proposed project (SAS, May 2019) included in Appendix G.

Desktop vegetation type information and the associated conservational status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006). Information on plant and animal species recorded for the Quarter Degree Squares (QDS), was extracted from the SABIF/SIBIS database hosted by SANBI.

Numerous national and provincial databases were utilised to determine the conservational sensitivity of the Tshipi Borwa Mine. These databases included:

- The National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA) list of threatened ecosystems (2011);
- Important catchments and protected expansion areas in terms of the National Protected Areas Expansion Strategy 2008 (NPAES);
- The South Africa Conservation Areas Database (SACAD, 2017);
- The South Africa Protected Area Database (SAPAD, 2017);
- The Mining and Biodiversity Guidelines (2013);
- The Griqualand West Centre of Endemism;
- The Northern Cape critical biodiversity areas (CBAs) (2016); and
- Important Bird Areas (IBA's) (2015)

Aerial photographical satellite images were used to identify homogenous vegetation/habitat units at the Tshipi Borwa Mine.

DESCRIPTION

Terrestrial characteristics

The desktop terrestrial characteristics of the Tshipi Borwa Mine is summarised in Table 7-8 below. The table below also provides information on the sensitivity of the Tshipi Borwa Mine in accordance with existing national and provincial databases. It is important to note, that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics. This information is however considered to be useful as background information. In this regard, the Tshipi Borwa Mine does not fall within any protected or priority areas.

The Tshipi Borwa Mine does however fall within the Griqualand West Centre of Endemism. A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. The Griqualand West Centre of Endemism is considered a priority in the Northern Cape, as the number of threats to the area is increasing rapidly and it is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority.

TABLE 7-8: DESKTOP TERRESTRIAL CHARACTERISTICS OF THE TSHIPI BORWA MINE (SLR, APRIL 2019)

Details of the project area in terms of Mucina & Rutherford (2006)	
Biome	The project area is situated within the Savanna Biome.
Bioregion	The project area is located within the Eastern Kalahari Bushveld Bioregion.
Vegetation Type	The project area is situated within the Kathu Bushveld.
Conservation details pertaining to the project area (Various databases)	
NBA (2011)	The project area falls within an area that is currently not protected.
National Threatened Ecosystems (2011)	The project area falls within an area that is least threatened.
NPAES (2009), SACAD (2017) & SAPAD (2017)	The project area is not located within or near any protected or conservation areas (within a 10km radius).
IBA (2015)	Not located within or near an Important Bird Area (IBA) (within 10 km).
Mining and Biodiversity Guidelines (2013)	
According to the Mining and Biodiversity guidelines, the project area is not ranked as a priority area, nor is it located near (within 10 km) an area considered to be of biodiversity importance.	
Northern Cape Critical Biodiversity Areas (2016)	
The majority of the project area falls within an area considered to be Other Natural Areas (ONA). According to the Technical Guidelines for Critical Biodiversity Area (CBA) Maps document, ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or Ecological Support Areas (ESAs) (SANBI, 2017).	
Northern Cape Provincial Spatial Development Framework (NPSDF, 2012)	
The proposed project area is situated within the Griqualand West Centre of Endemism and within the Gamagara Development Corridor. The corridor focuses on the mining of iron and manganese.	

Description of the vegetation type(s) relevant to the project area (Mucina & Rutherford 2006)	
Vegetation Type	Kathu Bushveld (further information provided below)
Climate	Summer and autumn rainfall, very dry winters
Altitude (m)	960 – 1 300
MAP* (mm)	375
MAT* (°C)	18.5
MFD* (Days)	27
MAPE* (mm)	2 883
MASMS* (%)	85
Distribution	Northern Cape Province
Geology & Soils	Aeolian red sand and surface calcrete, deep (>1.2 m) sandy soils of Hutton and Clovelly soil forms.
Conservation	Least threatened. Target 16%. None conserved.in statutory
Vegetation & landscape features	Medium-tall tree layer with *Vachellia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. Shrub layer generally most important with for example *Acacia mellifera, Diospyros lycioides* and *Lycium hirsutum*. Grass layer variable in cover.
Tall Tree	*Vachellia erioloba* (d)
Small Trees	*Senegalia mellifera* subsp. *detinens* (d), *Vachellia. leudertzii* var. *leudertzii* (k), *Boscia albitrunca* (d), *Terminalia sericea,*
Description of the vegetation type(s) relevant to the project area (Mucina & Rutherford 2006)	
Tall Shrubs	*Diospyros lycioides* subsp. *lycioides* (d), *Dichrostachys cinereal, Grewia flava, Gymnosporia buxifolia, Rhigozum brevispinosum*
Low Shrubs	*Aptosimum decumbens, Grewia retinervis, Nolletia arenosa, Sida cordifolia, Tragia dioica,*
Graminoids	*Aristida meridionalis* (d), *Brachiaria nigropedata* (d), *Centropedia glauca* (d), *Eragrostis lehmanniana* (d), *Schmidtia pappophoroides* (d), *Stipagrostis uniplumis, Tragus berteronianus, Anthephora argentea* (k), *Megaloprotachne albescens* (k), *Panicum kalaharense* (k)
Herbs	*Acrotome inflate, Erlangea misera, Gisekia Africana, Heliotropium cillatum, Hermbstaedtia fleckii, H. odorata, Limeum fenestratum, L. viscosum, Lotononis platycarpa, Senna italic* subsp. *arachoides, Tribulus* terrestris, *Neuradopsis bechuanensis* (k)

Habitat units and vegetation types at the Tshipi Borwa Mine

Two habitat units are located at the Tshipi Borwa Mine, namely the Kathu Thornbush habitat unit and the disturbed habitat unit (Figure 10). Further information pertaining to these habitat units is provided below.

Kathu Thornveld Habitat Unit

The Kathu Thornveld Habitat Unit is characterised by a well-developed herbaceous layer interspersed with woody species, notably that of *Grewia flava, Vachellia erioloba* and *Vachellia haematoxylon*, which are characteristic for the region. This habitat unit encompasses much of the current mining area. A number of small mammal species, invertebrates and avifauna where observed, evident that anthropogenic activities in this habitat unit are low and have had a minimal impact on the overall habitat utilization and behaviour of species. Overall, the habitat is considered to be in a good condition, and is populated by a high number of the protected tree species *Vachellia erioloba* and *Vachellia haematoxylon*, listed in the National Forest Act (1998) (as amended). Habitat integrity is deemed to be medium-high (SLR, April 2019).

Within the identified habitat units, the Tshipi Borwa mine site consists of three vegetation types, namely the Mixed *Vachellia* Savannah, the *Vachellia haematoxylon* Savannah and the *Grewia* Flava Scrub (SLR, August 2017) as illustrated in Figure 11. Further detail pertaining to the vegetation types is provided in Table 7-9 below.

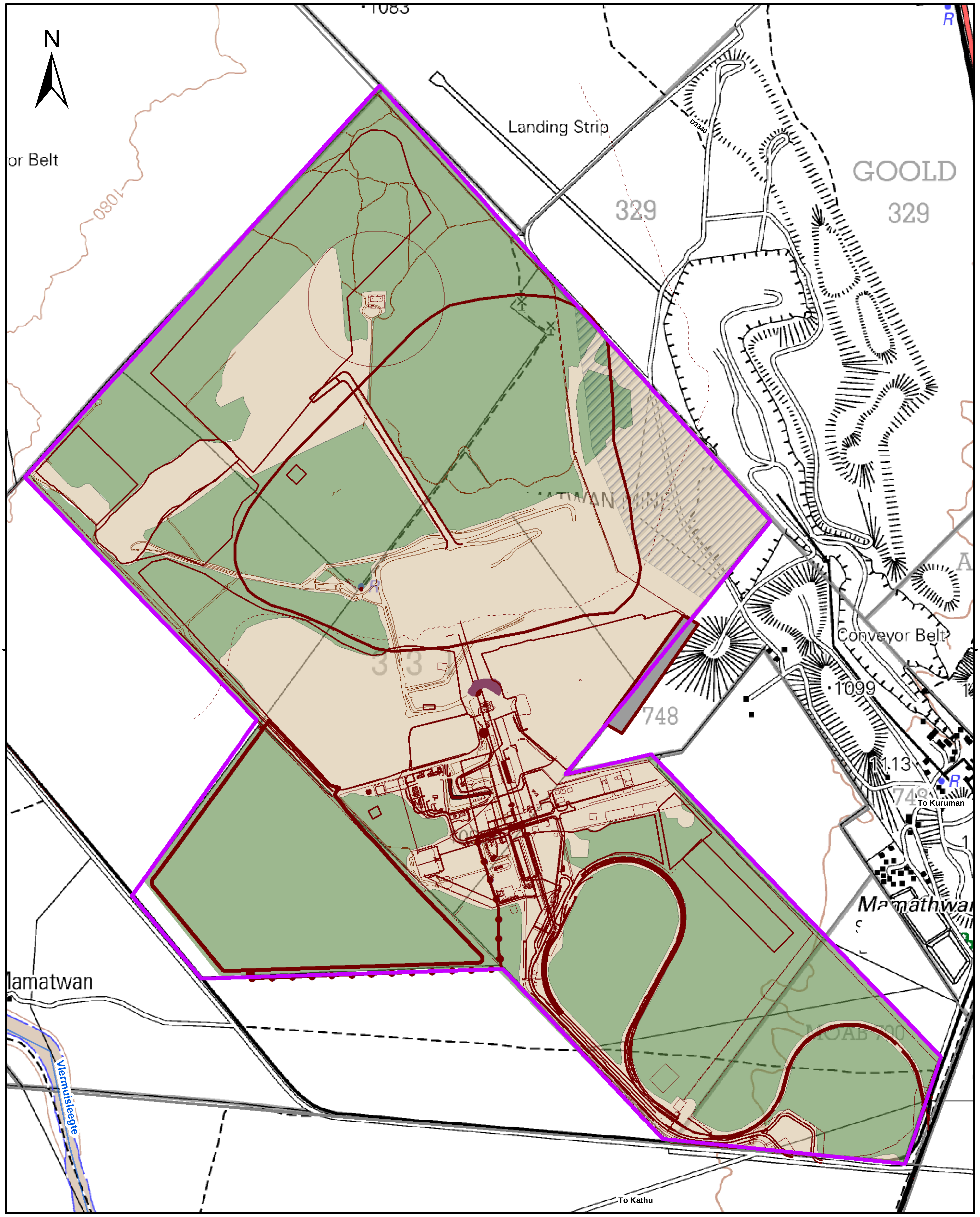
TABLE 7-9: VEGETATION TYPES DESCRIPTION (SLR, AUGUST 2017)

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

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

<u>Disturbed Habitat Unit</u>

This unit consists of the mining / infrastructure areas and the small pockets of vegetation remaining therein, or directly adjacent to (see Figure 10). This habitat unit, because of the development and daily functioning of the mine, has been subjected to increased levels of dust, vegetation clearing activities, dumping of excavated material and clearing of new roads. As a result, the natural vegetation has decreased, creating an ideal environment for the proliferation of alien and invasive plant species. Although habitat degradation has occurred, there were still several *Vachellia erioloba* and *Vachellia haematoxylon*, which are listed in the National Forest Act (1998) (as amended) were observed. Habitat integrity is deemed to be moderately low (SLR, April 2019).



Legend

- Tshipi Surface Use Area
- Mine Infrastructure - Approved
- Barrier Pillar

Habitat Units

- Kathu Thornveld
- Disturbed

0 200 400 Meters

Scale: 1:20 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

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Figure 10

Habitat Units

SLR

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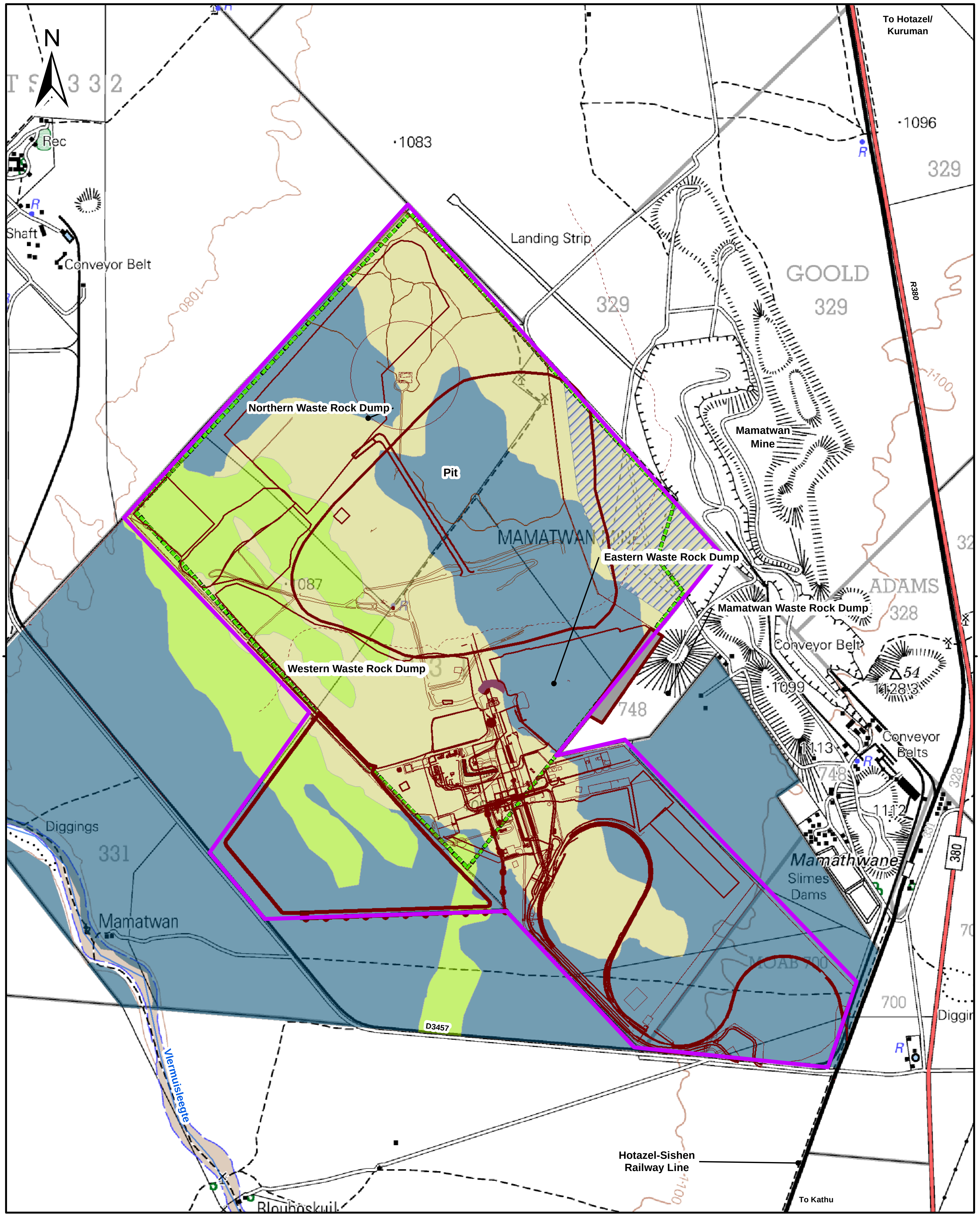

Legend

- Tshipi Surface Use Area
- Approved Mining Right Area
- Mine Infrastructure - Approved
- Barrier Pillar

Vegetation

- ***Vachellia haematoxylon*** Savannah
- ***Grewia flava*** Scrubs
- ***Mixed Vachellia*** Savannah

0 500 1 000 Meters

Scale: 1:25 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

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Figure 11

Vegetation Types (EMS, February 2017)

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Floral species of conservation concern

Several species of concern were identified at the Tshipi Borwa Mine during (SLR, April 2019). These included the Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon)* which are protected under the National Forest Act (No. 84 of 1998) (NFA). In addition to this, two other species were identifies within the Tshipi Borwa Mine area, namely Goldblatt (*Moraea longistyla) and Harpagophytum procumbens*, which are listed as specially protected under the Northern Cape Nature Conservation Act (No. 9 of 2009) (NCNCA). Other species of concern that are likely to occur at the Tshipi Borwa Mine are included in Table 7-10 below (SLR, April 2019).

TABLE 7-10: SPECIES OF CONCERN LIKELY TO OCCUR AT THE TSHIPI BORWA MINE (EMS, FEBRUARY 2017)

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

Floral alien invasive species

Alien invaders are plants that are of exotic origin and invade previously pristine areas or ecological niches. Alien invasive species cause a decline in species diversity, local extinction of indigenous species, ecological imbalance, decreased productivity of grazing pastures and increased agricultural costs. Alien invasive species likely to occur at the Tshipi Borwa Mine in terms of Regulation 15 and Regulation 16 of the Conservation of Agricultural Resources Act, 1983 (No. 43 of 1983) (CARA) are outlined in Table 7-11 below (SLR, April 2019).

According to the NEM:BA, Alien and Invasive Species list of July 2016, Category 1b species must be combatted or eradicated. Category, 2 species are those species that require a permit to carry out a restricted activity and Category 3 species are those that are subject to exemptions in terms of section 71 (3) and prohibitions in terms of Section 71A of GNR 958 of 2014.

According to the Regulation 15 and Regulation 16 CARA, Category 1 species must be removed and destroyed immediately. Category 2 species include alien invasive species that may only be grown under controlled conditions. Landowners are also required to make an application in writing to the executive authority under CARA to declare an area on which category 2 plants occur a demarcated area. In other areas, these species must be eradicated and controlled (SLR, April 2019).

TABLE 7-11: ALIEN INVASIVE SPECIES LIKELY TO OCCUR AT THE TSHIPI BORWA MINE)

Scientific name	Common name	NEMBA Category	CARA category
Argemone mexicana	Yellow flowered Mexican Poppy	1b	1
Atriplex nummularia	Old Man Salt Bush	2	2
Pennisetum setaceum	Fountain Grass	1b	1
Prosopis cf. glandulosa	Mesquite	3 in Northern Cape.	2
Opuntia humifusa	Large flowered prickly pear	1b	1
Achyranthes aspera	Burweed	1b	1
Xanthium spinosum	Spiny cocklebur	1b	1
Argemone ochroleuca	White flowered Mexican poppy	1b	1

Faunal species of conservation concern

Species of Conservation Concern (SCC) that could occur at the Tshipi Borwa Mine are included in Table 7-12 below. Although none of these SCC faunal species were observed at the Tshipi Borwa Mine, they are known to occur within the region, favouring the Kathu Thornveld habitat. This habitat unit provides suitable breeding and foraging resources for these species.

TABLE 7-12: FAUNAL SCC CONSIDERED LIKELY TO OCCUR IN THE KATHU THORNVELD OF THE STUDY AREA

Scientific Name	Common Name
Otocyon megalotis	Bat-eared fox
Vulpes chama	Cape fox
Ardeotis kori	Kori Bustard
Neotis ludwigii	Ludwig's Bustard
Python natalensis	African Rock Python
Mellivora capensis	Honey Badger
Atelerix frontalis	South African Hedgehog
Genus: *Ceratogyrus, Harpactira* and *Pterinochilus*	Baboon Spiders
Rhinolophus denti	Dent's Horseshoe Bat
Mellivora capensis	Honey badger
Atelerix frontalis	South African Hedgehog
Sagittarius serpentarius	Secretary bird
Polemaetus bellicoses	Martial Eagle

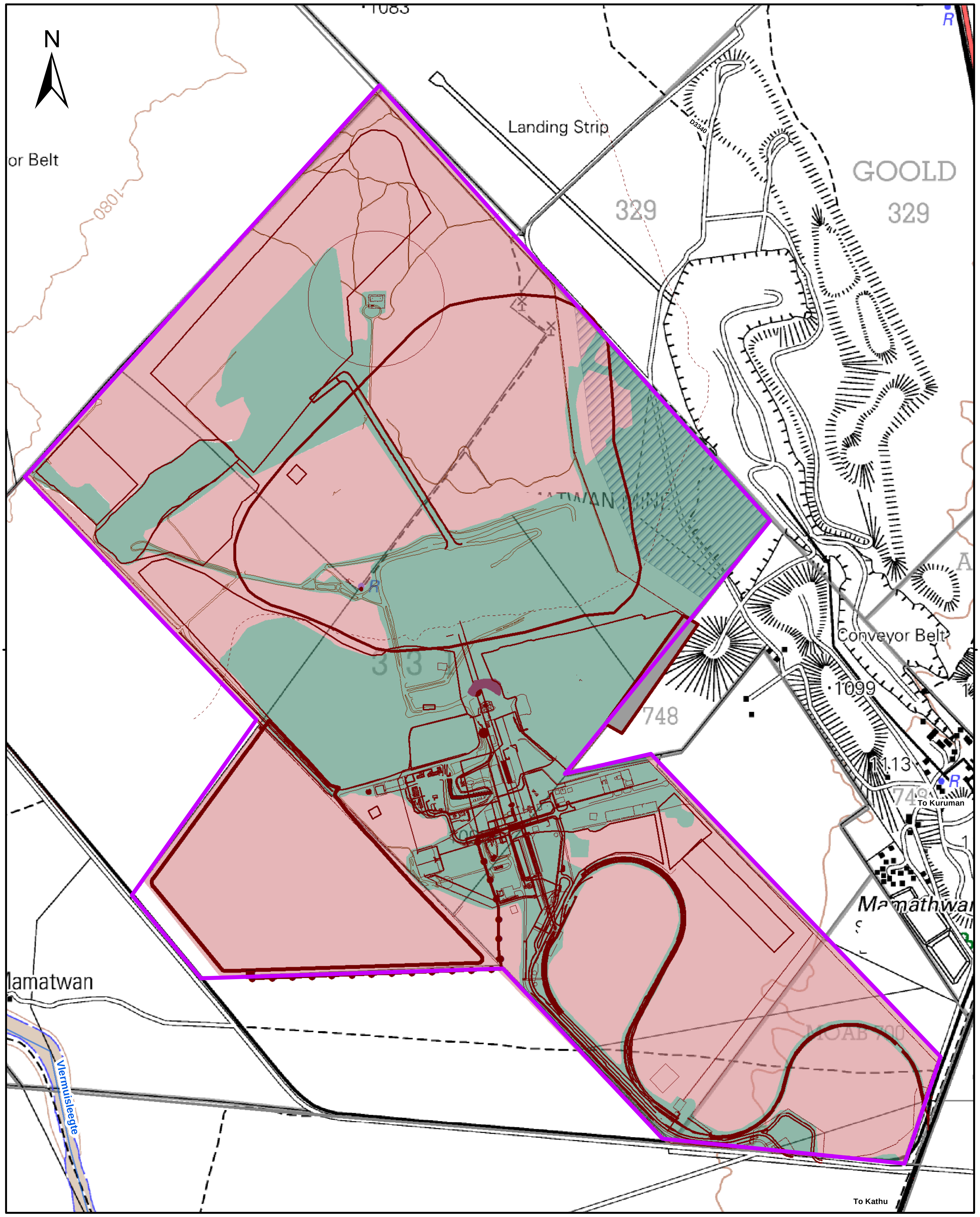
Site specific sensitivity

The ecological sensitivity of the Tshipi Borwa Mine area is linked to the two habitat units described above, specifically the presence or potential for floral and faunal SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The Kathu Thornveld Habitat Unit is deemed to be of **Moderately High** sensitivity, while the Disturbed Habitat Unit is **Moderately Low**. As such the conservation objective for the Kathu Thornveld habitat is to preserve and enhance the biodiversity of the habitat unit, and limit development and disturbance, while the objective for the Disturbed Habitat is to optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects (SLR, April 2019).

Aquifer Dependent Ecosystems (ADEs) occur throughout the South African landscape in areas where aquifer flows and discharge influence ecological patterns and processes. They are ecosystems, which require groundwater from aquifers for all or part of their life-cycle. ADEs provide habitats for an array of species, especially in arid areas, and are considered important in ecological processes and making available resources for the biodiversity in an area that would otherwise not be available. A study conducted by David Hoare Consulting (2013) showed that Camel Thorn (*Vachellia erioloba*) trees occurred as scattered to more concentrated individuals throughout the region. However, there appeared to be higher densities along the banks of the main channel of the Kuruman and Ga-Mogara Rivers in the area around Hotazel, and this could show that an ADE relationship exists between the ephemeral Rivers and the Camel Thorn *Vachellia erioloba* tree. No information is currently available on the fine scale distribution of ADEs, type of plant association, (singly, in stands or gallery forests), aquifer association, condition of vegetation etc. and, therefore, a precautionary approach should be taken when developing in and around these systems (SLR, April 2019).

Ecological characteristics of the current open pit

The current Tshipi pit is devoid of all but the hardiest alien plant species and tufts of grass (*Eragrosti*s spp), with these being observed sporadically along the southern slopes. The lack of habitat, continuous earth moving activities, dust and noise pollution as well current backfilling activities have left the pit area largely devoid of faunal species.



Legend

- Tshipi Surface Use Area
- Mine Infrastructure - Approved
- Barrier Pillar

Sensitivity

- Moderately High Sensitivity
- Low Sensitivity

0 200 400 Meters

Scale: 1:20 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

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Figure 12

Site Sensitivity

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CONCLUSION

The Tshipi Borwa Mine is located in the Kathu Bushveld. Protected species located at the Tshipi Borwa Mine include Camel Thorn (*Vachellia erioloba*) and the Grey Camel Thorn (*Vachellia haematoxylon*) which are protected under the NFA. Areas of moderately high and moderately low sensitivity are associated with the Tshipi Borwa Mine. It is important to note that the natural biodiversity on and surrounding the mine has already been influenced by existing mining activities and infrastructure. In this regard, projected tree species have been removed, with the necessary permits, and areas of moderately high sensitivity have been disturbed as part of clearing activities for the placement of approved mine infrastructure. Further to this, mining activities and infrastructure have the potential to directly disturb vegetation, vertebrates and invertebrates. It follows that the habitat ecosystem functionality has already been influenced by the Tshipi operations. Taking this into account, management actions and rehabilitation aimed at restoration and reclamation of lost habitats is an important component of closure planning.

7.4.1.6 Surface water

INTRODUCTION AND LINK TO IMPACT

Surface water resources include drainage patterns and paths of preferential flow of storm water runoff. Project-related activities have the potential to influence the natural drainage of surface water through the collection of run-off from stormwater management infrastructure around the waste rock dumps and collection in the partially open pit. The proposed project also has the potential to result in the contamination of the surface water resources through seepage and/or runoff from waste rock dumps and the pit lake.

DATA SOURCES

Information in this section was sourced from the approved EMPr (SLR, August 2017), the pit lake study compiled for the proposed project (SLR, June 2019) included in Appendix H.

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

DESCRIPTION

Catchments within the context of South Africa

The project area is located within the Lower Vaal Water Management Area. The major rivers associated with this water management area include the Molopo River, Harts River and the Vaal River, which ultimately drain into the Orange River (SLR, August 2017).

Regional hydrology

The Tshipi Borwa Mine falls within the quaternary catchment D41K (Figure 22) which has a gross total catchment area of 4216 km2, with a net mean annual run-off (MAR) of 6.53 million cubic meters (mcm) (SLR, August, 2018).

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

Local hydrology

The nearest watercourses to the Tshipi Borwa Mine are the ephemeral Vlermuisleegte River (approximately two km to the west of the mine) and the ephemeral Witleegte River (approximately 10km northeast of the mine) (Figure 13). It follows that no watercourses are located at the Tshipi Borwa Mine. Both the Vlermuisleegte and the Witleegte Rivers are tributaries of the Ga-Mogara River. The catchment characteristics of the Witleegte and the Vlermuisleegte Rivers are provided in Table 7-13 below. Any natural runoff from the Tshipi Borwa Mine will drain in a westerly direction towards the Vlermuisleegte River (SLR, August 2017).

TABLE 7-13: CATCHMENT CHARACTERISTICS

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

Surface water quality

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

Surface water use

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

Floodlines

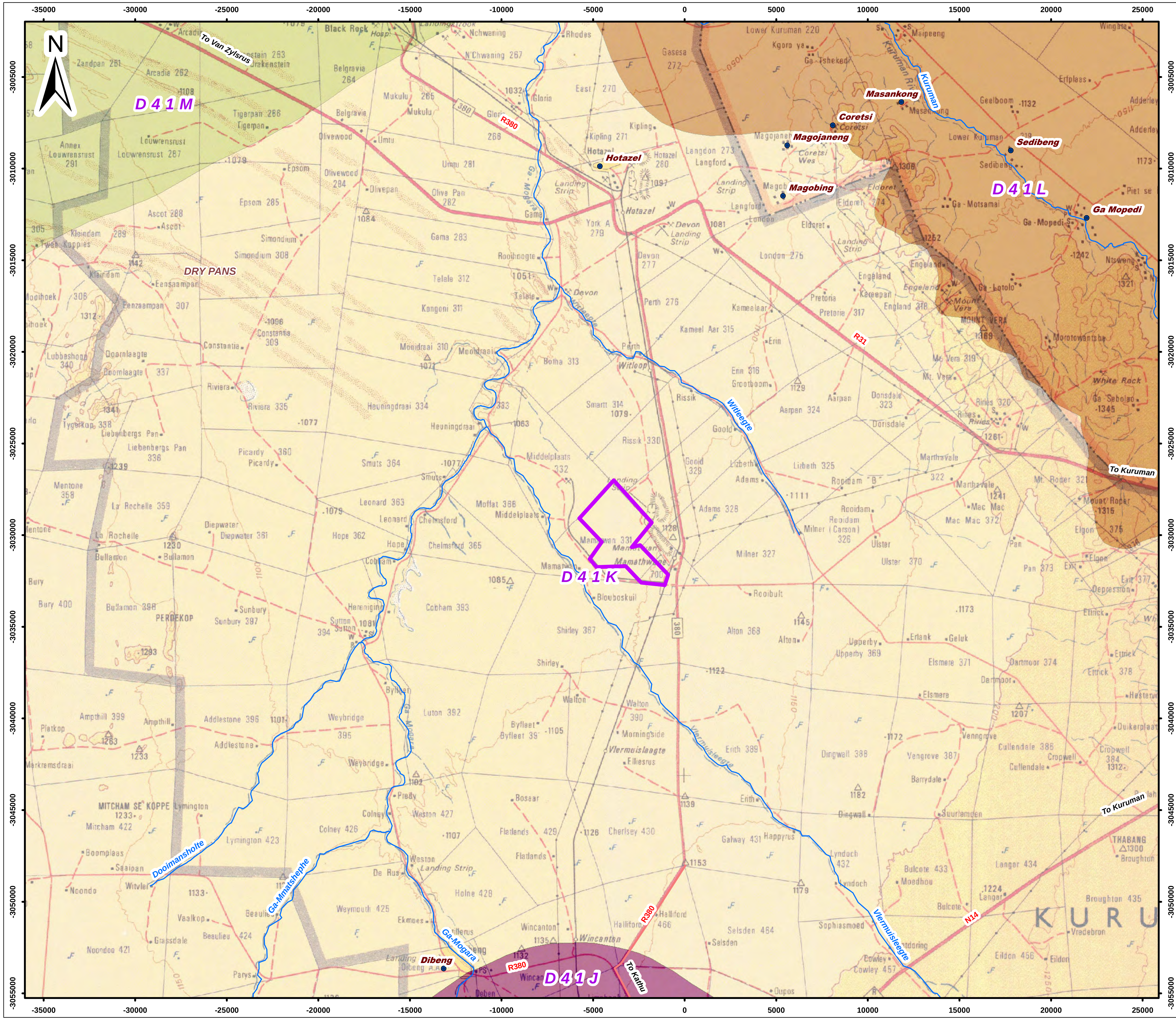
No floodlines were determined, as no watercourses are located within the project area.

Wetlands

No wetlands are located within the project area.

CONCLUSION

The presence of waste rock dumps post closure and a partially open pit (in which natural run-off can be collected) has the potential to influence natural drainage patterns and contributions of runoff to the catchment. The proposed project also presents a potential for the contamination of surface water resources in particular the pit lake. Closure related management actions are required to prevent the pollution of surface water resources and care is required to ensure that surface run-off patterns are disturbed as little as possible to promote the continued flow of water and nutrient.



Legend

- Tshipi Surface Use Area
- Main Roads
- Rivers

Quaternary Catchments

- D41J
- D41K
- D41L
- D41M

0 4 8 Kilometers

Scale: 1:2 000 000 @ A3

Projection:Transverse Mercator
Datum: Hartebeeshoek, Lo 23

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Figure 13

Catchments

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7.4.1.7 Groundwater

INTRODUCTION AND LINK TO IMPACT

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithological formations. The storage of waste rock (particularly in perpetuity) has the potential to impact the quality of groundwater resources. In addition, where mining has required dewatering in order to provide a safe working environment and for water supply, there is the potential for a dewatering cone to develop and this can result in a loss of water supply to surrounding users. As part of closure, these impacts can change in nature and extent. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the approved EMPr (SLR, August 2017), the pit lake study compiled for the proposed project (SLR, June 2019) included in Appendix H.

Information pertaining to aquifer characteristics was sourced from the Aquifer Classification Map of South Africa.

DESCRIPTION

Hydrogeology

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

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

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

Groundwater levels and flow

Groundwater flows across the mine area in accordance with the topography in a west-north-west direction. Average groundwater levels recorded as part of the approved EMPr (SLR, August 2017) and through on-going monitoring ranged from 20m to 74m below ground level. It is important to note that groundwater levels recorded prior to the establishment of the mine ranged between 20m to 45m below ground level. It follows that, there has been a decrease in some of the groundwater levels over time.

Groundwater use

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 (SLR, June 2019). Any water collected in the open pit at the Tshipi Borwa Mine is used for dust suppression.

Groundwater quality

A groundwater monitoring programme is currently in place at the Tshipi Borwa Mine. The results for the monitoring period 2008 to 2018 are summarised in Table 7-14 below. The groundwater quality data has been compared to the DWAF Livestock Drinking Water Standards. The results below indicate that parameters, Iron (Fe), Selenium (Se), Nitrate (N) and Total Dissolved Solids exceed the DWAF Livestock Drinking Water Standards.

TABLE 7-14: GROUNDWATER QUALITY DATA (SLR, JUNE 2019)

Sample Point		Determinants																							
		Al	As	B	Ba	Cd	Chloride as Cl	Cr (total)	Cu	Electrical Conductivity	Fe	Fluoride as F	Free & Saline Ammonia	Mn	Na	Ni	Nitrate as N	Pb	pH	Sb	Se	Sulphate as SO4	Total Dissolved Solids	Zn	Nitrite as N
Units		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mS/m	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ph unit	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Livestock Drinking Water Standards		5	1		5	0.01	1500 – 3000	1 (CrVI)	0.5 – 5		10	2		10	2000	1	100	0.1			0.05	1000	1000 – 3000	20	
NT1	Count	4	5	21	19		22		6	21	9	17	4	7	22	4	21		21	1	2	22	21	20	
	Min	0.01	0.01	0.024	0.019	n.d	22	n.d	0.01	52	0.019	0.2	0.1	0.009	11	0.009	0.7	n.d	7.2	0.003	0.014	8	284	0.012	n.d
	Average	0.09	0.012	0.24	0.081		44		0.041	75	0.093	0.3	0.2	0.027	30	0.022	5.4		8.1	0.003	0.016	48	463	0.4	
	max	0.24	0.014	2.90	0.13		184		0.11	154	0.29	1	0.3	0.047	153	0.054	12		8.5	0.003	0.018	336	1010	5.7	
NT13	Count			1	1		1	1	1	1	1	1		1	1		1		1			1	1	1	
	Min	n.d	n.d	0.017	0.093	n.d	61	1.09	0.063	80	6.92	0.3	n.d	0.17	39	n.d	2.2	n.d	8.3	n.d	n.d	58	504	0.2	n.d
	Average			0.017	0.093		61	1.09	0.063	80	6.92	0.3		0.17	39		2.2		8.3			58	504	0.2	
	max			0.017	0.093		61	1.09	0.063	80	6.92	0.3		0.17	39		2.2		8.3			58	504	0.2	
NT14	Count			1	1		1			1	1	1			1		1		1		1	1	1	1	
	Min	n.d	n.d	0.23	0.064	n.d	56	n.d	n.d	101	0.15	0.2	n.d	n.d	45	n.d	16	n.d	7.5	n.d	0.046	47	592	0.2	n.d
	Average			0.23	0.064		56			101	0.15	0.2			45		16		7.5		0.046	47	592	0.2	
	max			0.23	0.064		56			101	0.15	0.2			45		16		7.5		0.046	47	592	0.2	
NT15	Count	2	5	25	26		26		1	25	10	18	6	5	26	5	25		25		20	25	24	13	
	Min	0.05	0.02	0.05	0.02	n.d	126	n.d	0.014	70	0.01	0.2	0.1	0.01	38	0.01	45	n.d	6.8	n.d	0.01	25	354	0.012	n.d
	Average	0.07	0.06	0.13	0.22		677		0.014	357	0.25	0.3	2.4	0.11	63	0.03	168		7.4		0.06	45	2712	0.6	
	max	0.09	0.13	0.34	0.51		805		0.014	412	1.90	0.9	14	0.47	98	0.08	197		8.2		0.24	53	4166	3.4	
NT17	Count			1	1		1			1	1	1			1		1		1		1	1		1	
	Min	n.d	n.d	0.27	0.21	n.d	172	n.d	n.d	186	0.11	0.4	n.d	n.d	85	n.d	111	n.d	7.4	n.d	0.06	52	n.d	0.1	n.d
	Average			0.27	0.21		172			186	0.11	0.4			85		111		7.4		0.06	52		0.1	
	max			0.27	0.21		172			186	0.11	0.4			85		111		7.4		0.06	52		0.1	
NT18	Count			1	1		1		1	1	1	1			1		1		1			1		1	
	Min	n.d	n.d	0.25	0.17	n.d	304	n.d	0.025	243	0.037	0.4	n.d	n.d	88	n.d	101	n.d	7.2	n.d	n.d	126	n.d	0.1	n.d
	Average			0.25	0.17		304		0.025	243	0.037	0.4			88		101		7.2			126		0.1	
	max			0.25	0.17		304		0.025	243	0.037	0.4			88		101		7.2			126		0.1	
NT6	Count	2	1	10	10		11		4	10	10	11		4	11		10		10		1	11	10	9	
	Min	0.02	0.01	0.07	0.012	n.d	50	n.d	0.015	73	0.014	0.3	n.d	0.001	34	n.d	1.3	n.d	7.3	n.d	0.074	15	432	0.01	n.d
	Average	0.069	0.01	0.70	0.11		82		0.027	99	0.15	0.5		0.012	63		9.7		7.9		0.074	71	631	0.09	
	max	0.12	0.01	2.51	0.20		182		0.045	157	0.52	0.7		0.025	158		21		8.7		0.074	312	1068	0.2	
NT8	Count	4	10	23	19		25		3	24	15	24	7	18	25	5	14		24		10	22	23	20	1
	Min	0.02	0.012	0.14	0.008	n.d	62	n.d	0.015	56	0.013	0.3	0.6	0.002	45	0.010	0.10	n.d	7.6	n.d	0.011	2	314	0.01	0.4
	Average	0.09	0.02	1.53	0.091		171		0.024	123	0.28	0.7	4.3	0.12	125	0.016	5		8.1		0.029	227	781	0.2	0.4
	max	0.15	0.043	3.11	0.31		275		0.029	179	2.16	1	24	0.41	237	0.022	32		8.7		0.076	481	1158	1.8	0.4
NT9	Count			1			1			1		1			1		1		1		1	1	1	0	
	Min	n.d	n.d	0.40	n.d	n.d	40	n.d	n.d	82	n.d	0.2	n.d	n.d	74	n.d	14	n.d	7.9	n.d	0.042	25	420		n.d
	Average			0.40			40			82		0.2			74		14		7.9		0.042	25	420		
	max			0.40			40			82		0.2			74		14		7.9		0.042	25	420		
TSH01	Count	6	3	17	17		17			17	7	17	3	10	17	3	16	1	17		8	17	17	16	
	Min	0.070	0.011	0.39	0.01	n.d	125	n.d	n.d	88	0.12	0.3	0.1	0.011	63	0.01	18	0.21	7.6	n.d	0.010		384	0.037	n.d
	Average	0.20	0.015	1.44	0.082		141			102	7.58	0.6	0.1	0.56	87	0.014	21	0.21	7.9		0.019	65	594	0.5	
	max	0.33	0.021	2.15	0.27		160			111	21.9	0.8	0.2	3.52	125	0.02	2	0.21	8.3		0.038	78	681	3.2	
TSH02	Count	2		8	9	1	9		1	9	4	8	1	5	9	1	8		9	1	3	9	9	5	
	Min	0.01	n.d	0.16	0.011	0.002	106	n.d	0.024	86	0.030	0.3	8.9	0.014	65	0.01	0.3	n.d	7.9	0.003	0.011	28	435	0.01	n.d
	Average	0.021		0.23	0.103	0.002	165		0.024	141	0.051	0.4	8.9	0.089	89	0.01	54		8.4	0.003	0.012	66	875	0.03	

Sample Point		Determinants																							
	max	0.032		0.35	0.16	0.002	345		0.024	169	0.092	0.5	8.9	0.27	122	0.01	90		8.8	0.003	0.012	128	1188	0.06	
TSH03	Count	3	n.d	19	20	n.d	20	n.d	2	20	16	20	6	20	20	5	12	1	20	3	4	7	20	13	n.d
	Min	0.013		0.23	0.073		26		0.015	38	0.049	0.2	1.2	0.095	14	0.015	0.1	0.015	7.7	0.003	0.013	2	215	0.01	
	Average	0.046		0.38	0.19		110		0.018	64	1.56	0.7	4.3	0.30	50	0.035	0.6	0.015	8.0	0.007	0.025	6	339	0.04	
	max	0.070		0.59	0.59		131		0.021	77	5.18	1.2	7.9	0.74	127	0.10	2.7	0.015	8.9	0.015	0.033	21	444	0.2	
TSH04	Count	6	n.d	19	20	1	20	1	1	20	17	17	7	19	20	6	10	1	20	1	6	7	20	16	n.d
	Min	0.101		0.091	0.01	0.001	33	0.002	0.017	78	0.04	0.2	24	0.042	16	0.002	0.1	0.046	7.5	0.003	0.01	2	268	0.01	
	Average	0.48		0.41	0.16	0.001	139	0.002	0.017	126	4.54	0.4	96	0.89	70	0.052	1.6	0.046	8.1	0.003	0.02	8	494	0.04	
	max	1.37		0.64	0.60	0.001	168	0.002	0.017	233	21.3	0.7	163	3.22	99	0.11	13	0.046	9.4	0.003	0.029	22	734	0.1	
TSH05	Count	5	n.d	9	10	n.d	10	n.d	n.d	10	8	2	n.d	9	10	3	8	n.d	10	n.d	5	10	10	2	n.d
	Min	0.098		0.07	0.021		321			165	0.027	0.2		0.044	37	0.012	0.2		7.5		0.010	44	842	0.01	
	Average	0.24		0.15	0.058		353			182	2.80	0.2		0.37	92	0.021	22		8.5		0.020	63	994	0.01	
	max	0.67		0.21	0.11		379			204	8.37	0.2		1.01	123	0.030	77		9.4		0.029	76	1362	0.01	
TSH06	Count	n.d	1	7	7	n.d	7	n.d	n.d	7	5	7	6	7	7	2	4	1	7	n.d	3	4	7	4	n.d
	Min		0.011	0.52	0.047		167			139	0.060	0.3	50	0.089	62	0.002	0.1	0.053	6.9		0.034	3	350	0.03	
	Average		0.011	0.70	0.12		179			151	1.57	0.4	100	0.50	64	0.016	14	0.053	7.8		0.043	3	469	0.04	
	max		0.011	0.82	0.42		186			163	4.42	0.6	115	1.82	67	0.030	55	0.053	8.1		0.051	4	677	0.04	
TSH07	Count	n.d	n.d	4	4	n.d	4	n.d	n.d	4	1	4	4	4	4	1	4	n.d	4	1	1	4	4	1	1
	Min			0.33	0.027		77.6			64	0.44	0.2	0.8	0.056	58	0.003	0.3		7.5	0.003	0.042	25	430	0.04	5.6
	Average			0.508	0.11		131			120	0.44	0.5	3	0.35	60	0.003	33		7.8	0.003	0.042	34	728	0.04	5.6
	max			1.01	0.16		153			152	0.44	0.6	8	0.52	64	0.003	60		8.1	0.003	0.042	43	949	0.04	5.6
TSH08	Count	n.d	n.d	3	3	n.d	3	n.d	n.d	3	1	3	2	2	3	n.d	3	n.d	3	2	1	3	3	2	n.d
	Min			0.164	0.006		133			97	0.034	0.2	11	0.022	57		0.4		8.0	0.002	0.033	56	511	0.02	
	Average			0.248	0.027		138			103	0.034	0.3	14	0.025	67		8.7		8.2	0.002	0.033	87	578	0.03	
	max			0.413	0.068		144			113	0.034	0.5	16	0.027	73		14		8.4	0.002	0.033	105	641	0.04	
TSH09	Count	n.d	2	5	4	n.d	5	n.d	n.d	5	n.d	3	5	4	5	n.d	5	n.d	5	n.d	2	5	5	3	n.d
	Min		0.015	0.14	0.016		183			138		0.4	0.1	0.008	70		0.1		7		0.051	21	802	0.009	
	Average		0.015	0.76	0.070		251			172		0.7	12	0.15	94		66		8		0.051	74	1065	0.07	
	max		0.015	2.55	0.173		317			237		0.9	20	0.42	158		146		8.5		0.051	231	1608	0.13	
TSH10	Count	n.d	0	5	5	n.d	5	n.d	n.d	5	n.d	2	4	5	5	n.d	5	n.d	5	3	2	5	5	3	2
	Min			0.228	0.024		165			115		0.5	18	0.005	80		0.3		7.7	0.003	0.052	24	601	0.01	0.6
	Average			0.243	0.065		194			138		0.5	21	0.049	83		18		8.2	0.004	0.052	27	754	0.03	0.6
	max			0.272	0.159		210			174		0.5	24	0.14	87		66		8.5	0.004	0.052	29	1014	0.04	0.6

CONCLUSION

Current groundwater quality data indicates that Iron (Fe), Selenium (Se), Nitrate (N) and Total Dissolved Solids exceed the DWAF Livestock Drinking Water Standards. In terms of groundwater quantity, there has been a decrease in the groundwater levels over time. The nature of mining is such that there is a potential for pollution of groundwater resources. At closure the proposed project will present final land forms (waste rock dumps) and waste rock backfilled into the open pit that may have the potential to pollute water resources through long term seepage and/or run-off. While current dewatering operations are associated with a predicted decrease in groundwater levels, at closure, groundwater levels will start to rebound. Both quantity and quality related aspects are important in the context of closure planning.

7.4.1.8 Air quality

INTRODUCTION AND LINK TO IMPACT

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

DATA SOURCES

Information in this section was sourced from the approved EMPr (SLR, August 2019) and the air quality study undertaken for the proposed project (Airshed, June 2019) including in Appendix I.

DESCRIPTION

Ambient air quality within the region

The following regional sources of emissions were identified (SLR, August 2017):

- Fugitive dust: Occur as a result of vehicle entrainment of dust from local paved and unpaved roads, wind erosion from open areas and dust generated by agricultural activities. Given that the agriculture in the area is primarily restricted to livestock and game farming, agriculture is not anticipated to contribute significantly to ambient dust rates. Vehicle entrainment from the various unpaved farm and public roads is anticipated to be a significant, but localised source of dust;
- Current mining operations in the area: Particulates represent the main pollutant of concern at mining operations, whether it is underground or opencast. Greenhouse gas emissions from stationary fossil fuel combustion are also a significant contributor. The amount of dust emitted by these activities depends on the physical characteristics of the material, the way in which the material is handled and the weather conditions. Current mining operations in relatively close proximity to the mining area include Kalagadi, Tshipi, Black Rock, Gloria, Wessels, Sebilo, United Manganese of Kalahari (UMK) and Kudumane;
- Biomass burning: Biomass burning emissions include with carbon monoxide (CO), methane (CH_4) and nitrogen dioxide (NO_2) gases;
- Veld burning: represent significant sources of combustion-related emissions in many areas of the country;

- Rail related emissions: Emissions from diesel generated locomotives include particulates, nitrogen oxides (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and various volatile organic compounds including polycyclic aromatic hydrocarbons;
- Household fuel combustion: It is likely that households within the district municipality utilise coal or wood for cooking and space heating (during winter) purposes. Emissions from domestic burning include PM_{10}, nitrogen dioxide (NO_2), carbon dioxide (CO_2), carbon monoxide (CO), polycyclic aromatic hydrocarbons, particulate benzo(a)pyrene and formaldehyde; and
- Vehicle tailpipe emissions: Significant primary pollutants include carbon dioxide (CO_2), carbon monoxide (CO), hydrocarbons (HCs), sulphur dioxide (SO^2), oxides of nitrogen (mainly NO_x), particulates. Secondary pollutants include NO^2, photochemical oxidants (ozone), sulphur acid, sulphates and nitric acid.

Current emission sources

Current activities that contribute to ambient air quality include:

- Diesel generators;
- Vehicle tail pipe emissions;
- Material handling such as crushing, tipping of waste rock and ore, conveying of ore, stockpiles;
- Dust generation from open pit operations (blasting and material handling);
- Vehicle activity on paved and unpaved roads;
- Wind erosion from exposed working surfaces;
- Excavations;
- Earthworks; and
- Removal of soil.

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

Dust fallout data

A dustfall monitoring network is in place at Tshipi Borwa Mine, comprising of five directional dustfall units (DW-01 to DW-5). Data is also reported for five single dust fallout units (SW-01 to SW-05). Refer to Figure 17 for the location of the dust buckets. Dustfall results for the period January 2017 to May 2018 for the single units are provided in Table 7-15 From the data, it is evident that the dustfall is high at and around the mine, exceeding the National Dust Control Regulations (NDCR) for non-residential areas of 1 200 mg/m²/day, often.

It is important to note that due to the way that data from directional dust buckets is presented, this data cannot be compared to the NDCR and these will only provide an indication of which direction dust fallout is associated with.

TABLE 7-15: DUSTFALL RATES AT TSHIPI BORWA MANGANESE MINE (AIRSHED, JUNE 2019)

Start date	End date	Days Exposed	Dustfall rates (mg/m²/day)				
			SB-01	SB-02	SB-03	SB-04	SB-05
11/01/2017	27/02/2017	47	-	1 075	676	1 097	636
27/02/2017	30/03/2017	31	-	1 473	1 343	1 480	1 266
30/03/2017	02/05/2017	33	-	1 375	1 193	1 642	1 119
02/05/2017	30/05/2017	28	-	841	725	771	940
30/05/2017	28/06/2017	29	-	2 003	1 069	1 336	826
28/06/2017	27/07/2017	29	-	1 338	833	1 147	632
27/07/2017	31/08/2017	35	1 680	2 234	1 333	1 539	-
31/08/2017	03/10/2017	33	1 248	2 245	1 618	1 369	-
03/10/2017	30/10/2017	27	831	1 238	726	932	-
30/10/2017	29/11/2017	30	1 325	1 209	866	930	-
29/11/2017	14/12/2017	15	1 495	1 095	1 051	944	1 420
14/12/2017	15/02/2018	63	-	1 933	1 234	1 371	1 162
15/02/2018	19/04/2018	63	-	2 290	930	1 150	594

Notes: Highlighted cells indicate exceedances of the NDCR non-residential limit of 1 200 mg/m²/day

Minimum, maximum and average dustfall rates were provided for the single dustfall units for the period 14 December 2017 to 13 December 2018. These dustfall rates are provided in Table 7-16 below.

In this regard, the minimum dustfall rate for SB-01 exceeded the residential limit of 600 mg/m^2/day, but the remaining units were within the non-residential limit of 1 200 mg/m^2/day. However, all maximum rates exceeded the applicable NDCR limits at all locations.

TABLE 7-16: MINIMUM, AVERAGE AND MAXIMUM DUSTFALL RATES FROM THE SINGLE DUSTFALL UNITS (AIRSHED, JUNE 2019)

	Dustfall rates (mg/m²/day)				
	SB-01	SB-02	SB-03	SB-04	SB-05
Minimum	694.4	532.3	783.7	820.4	681.4
Average	983.0	1 129.5	1 185.8	1 330.4	950.5
Maximum	1 405.2	1 616.8	1 936.5	1 795.6	1 522.4

PM10 data

PM_{10} sampling campaigns have been on-going since October 2015 at the dust fallout locations and next to the silo. The 24-hour results from the eight campaigns indicate elevated PM_{10} levels around the mine, exceeding the daily limit of 75 µg/m³ in terms of the National Ambient Air Quality Standards (NAAQS) for all the campaigns at almost all the locations. The sampling campaigns only covered a single day in 2015, five (5) days in 2017 and two (2) days in 2018, thus compliance evaluation is not possible – the NAAQS allows 4 days in a calendar year where the standard can be exceeded. It is therefore likely that the ambient air quality around the mine is in non-compliance with the NAAQS. No data was made available after May 2018 (Airshed, June 2019).

TABLE 7-17: PM_{10} DAILY CONCENTRATIONS AT TSHIPI BORWA MANGANESE MINE (AIRSHED, JUNE 2019)

Date	SB-01	SB-02	SB-03	SB-04	SB-05	Next to Silo
Oct-15	125	93.7	541.7	187.5	ND	1 218.7
May-17	256.9	423.6	0	381.9	809	329.9
Aug-17	73	181	660	160	1316	233
Sep-17	253.5	180.6	211.8	ND	ND	69.4
Oct-17	288.2	430.6	468.7	291.7	83.3	72.9
Dec-17	135.4	93.8	215.3	111.1	784.7	180.6
Feb-18	93.75	0	135.42	208.33	114.58	291.67
May-18	552.08	114.58	187.5	708.33	239.58	625

Notes: ND is No Data. The NAAQS for PM_{10} 24-hour is 75 µg/m³ not to be exceeded for more than 4 days in a year.

Potential air receptors

Potential receptors include the isolated residences and farmhouses on the surrounding farms. Further detail is provided in Section 7.4.2.

CONCLUSION

Air quality within and surrounding the Tshipi Borwa Mine has already been influenced through the presence of approved infrastructure and activities. In this regard, monitoring results indicate that mining and surrounding activities and infrastructure contribute towards sources of emissions such as dust fallout and PM_{10} that occasionally exceed relevant NAAQS and NDCR limits. At closure, the sources of emissions will be significantly less; however, the proposed project has the potential to generate wind-blown dust from large exposed areas such as un-rehabilitated waste rock dumps. It follows, that rehabilitation should ensure that contributions post closure remain within acceptable limits.

7.4.1.9 Noise

INTRODUCTION AND LINK TO IMPACT

A change in on site noise generating is likely to result in a change to ambient noise levels experienced in and surrounding the mining area. Land uses surrounding the mine are described in Section 7.4.2. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from noise study undertaken for the proposed project (Airshed, June 2019) included in Appendix J.

Background environmental noise levels were sampled at five locations to the south west and west of the Tshipi Borwa Mine as well as one location between Tshipi Borwa Mine and the Mamatwan Mine. These levels were measured at a time when the mining operations were active.

DESCRIPTION

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

Sampled background environmental noise levels are summarised in Table 7-18 below. Recorded average sound pressure levels (LAeq) were below the IFC guideline for residential areas at all five sampling locations. Recorded baseline sound pressure levels at sampling locations 1 and 3 were typical of rural locations while sound pressure levels at locations 2, 4 and 5 were slightly higher (equivalent to typical suburban noise levels) due to the presence of cicadas (insects) close to the sampling locations.

TABLE 7-18: BACKGROUND ENVIRONMENTAL NOISE LEVELS (AIRSHED, JUNE 2019)

	IFC Noise level Guidelines		SANS 10103		Site 1	Site 2	Site 3	Site 4	Site 5
	Residential One Hour LAeq (dBA) 07:00 to 22:00	Residential One Hour LAeq (dBA) 22:00 to 07:00	Rural districts	Suburban districts					
L_{Aeq}	55	45	45	50	44.1	51.2	45.8	49.7	53.4

Potential noise receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 1 and 2 km from the Tshipi Borwa Mine. These are owned and/or occupied by farmers and farm workers. Further information is provided in Section 7.4.2.

CONCLUSION

Current Tshipi operations contribute towards ambient noise levels; however monitoring results indicate that noise levels do not exceed the IFC guideline limits for residential areas. While post closure activities will be significantly less than that of current mining operations, post closure activities should be undertaken in a manner that manages disturbing noise levels.

7.4.1.10 Visual aspects

INTRODUCTION AND LINK

Mining infrastructure has the potential to alter the landscape character at the Tshipi Borwa Mine and surrounding area through permanent infrastructure such as the presence of waste rock dumps post closure. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from the visual study (Graham Young, June 2019) undertaken for the proposed project included in Appendix K.

DESCRIPTION

Visual value has been determined by considering landscape character, scenic quality, sensitivity of the visual resource, sense of place and visual receptors. Each of these is described below.

Landscape character

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

Scenic quality

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

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

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

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

Sensitivity of Visual Resource

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

Sense of place

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

Visual receptors

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

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

CONCLUSION

When considering landscape character, scenic quality, visual resource, sense of place and visual receptors, the area to the southwest and west of the Tshipi Borwa Mine surface use area has a high visual value. The areas within the Tshipi Borwa Mine surface use area as well as areas located to the north, northwest and east of the surface use area that have been disturbed have a low visual value. This indicates that mining and infrastructure activities impact on the available visual resources. In the absence of rehabilitation, the proposed project has the potential to impact on the visual environment so it is important to include visual considerations as part of closure planning.

7.4.1.11 Heritage / cultural and palaeontological resources

INTRODUCTION AND LINK

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

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

DATA SOURCE

Information in this section was sourced from the approved EMPr (SLR, August 2017).

DESCRIPTION

The Tshipi Borwa Mine is situated in an area that as a whole has a relatively low human presence due to the dryness of the region, and as such if there are human settlements they tend to be located on or near water courses. No heritage sites are located at the Tshipi Borwa Mine.

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

CONCLUSION

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

Palaeontological and heritage resources are important to the history of South Africa and are protected by national legislation. It follows that in the event on any chance finds, South African Heritage Resources Agency (SAHRA) needs to be notified and where necessary permits need to be obtained prior to disturbance.

7.4.1.12 Socio-economic

INTRODUCTION AND LINK

The proposed project has the potential to result in both positive and negative socio-economic impacts.

DATA SOURCE

Information in this section was sourced from the Joe Morolong Local Municipality Integrated Development Plan of 2016 and StatsSA provided in the approved EMPr (SLR, April 2019).

DESCRIPTION

The Tshipi Borwa Mine 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 18km north of the mine. No informal or rural type settlements occur within the surrounding areas.

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

In general, statistics throughout the identified regions indicate poor educational profiles. Significant numbers of the population within the municipalities and province have received no schooling or only limited primary education. The average number across the regions profiled of people completing high school education were relatively consistent; however, there is greater disparity when considering Grade 12 education, further education and training and tertiary education. The education profile within Hotazel is more positive in terms of the percentage of the population that have received further education and tertiary education when compared to the province and district and local municipalities.

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

The population profile of the Northern Cape Province, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality demonstrates a consistent average household size of four people per household despite the significant decline in population numbers between the regional levels. The local community of Hotazel has an average of three members per household. These results are relatively typical of rural or semi-rural developing communities, however the low household density within Hotazel may be attributed to the fact that the town is largely a mining community established for and servicing surrounding mines.

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

In general, despite the relatively formalized housing infrastructure, basic services infrastructure appears to be far less formalized when considering the province and municipalities as a whole. In general, Hotazel is well formalised in terms of basic services. This may be attributed to the Hotazel area being more urbanized having been developed and supported by surrounding mines in recent years.

CONCLUSION

The proposed project has the potential to influence socio-economic conditions both positively and negatively to which the approved mine already contributes. In this regard, the proposed project has the potential to have a positive net economic impact on the national, local and regional economy by allowing for the efficient exploitation of future underground resources located to the north of the current open pit. Negative socio-economic influences include inward migration of people with the resultant pressure on basic infrastructure and services. As part of the proposed project, care should be taken to avoid influencing negative socio-economic impacts further and enhancing positive socio-economic conditions.

7.4.2 CURRENT LAND USES

INTRODUCTION AND LINK

Mining-related activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. To understand the basis of the potential land use impacts, a baseline situational analysis is described below.

DATA SOURCE

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

DESCRIPTION

Tshipi Mining Right

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

Mamatwan Mining (forms part of the Hotazel Manganese Mining (Pty) Ltd legal entity) holds the mining right on the remaining extent, portion 3 (Currently portion 18) and portion 8 of the farm Mamatwan 331. Mamatwan Mining also holds a mining right (NC 252 MR) on portion 3 of the farm Moab 700. As per an agreement between Tshipi and Mamatwan Mining, Mamatwan Mining will relinquish the mining right on portion 8 of the farm Mamatwan 331 for incorporation into the Tshipi mining right.

Landowners within and surrounding the Tshipi Borwa mine

The surface right owners and corresponding title deeds numbers of the land in and adjacent to the Tshipi Borwa Mine surface use and mining rights areas is listed in Table 7-19 and Table 7-20 respectively.

TABLE 7-19: LAND OWNERSHIP WITHIN THE TSHIPI BORWA MINE SURFACE USE AND MINING RIGHTS AREAS

Portion	Landowner	Title deed number
Mamatwan 331		
Portion 16 (Portion of portion 1)	Tshipi	T416/2014
Portion 17 (Portion of portion 2)	Tshipi	T416/2014
Portion 18 (Portion of portion 3)	Tshipi	T416/2014
Portion 8	Tshipi	T515/1992
Moab 700		
Remaining extent	Machiel Andries Kruger	T594/1987

TABLE 7-20: LANDOWNERS ADJACENT TO THE TSHIPI BORWA MINE SURFACE USE AND MINING RIGHTS AREAS

Portion	Landowner	Title deed number
Mamatwan 331		
Remaining extent	Andries Mathys Van Den Berg	T594/ 1987
Portion 1	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 2		T2426/2010
Portion 3		T953/2009
Portion 7	Transnet	T666/1965
Moab 700		
Portion 1	Transnet (Pty) Ltd	T250/1983
Portion 3	Hotazel Manganese Mines (Pty) Ltd	T953/2009
Sinterfontein 748		
Portion 0	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Middelplaats 332		
Remaining Extent	Saltrim Ranches (Pty) Ltd	T2297/2006
Portion 1	Terra Nominees (Samancor Manganese)	T2397/1996
Portion 4	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Middleplaats 184		
Whole farm	Abraham Johannes De Klerk	T1135/1965
Adams 328		
Remaining Extent	Saltrim Ranches (Pty) Ltd	T2297/2006
Portion 1	Eskom Holdings	T347/1971
Portion 2		T1162/1982
Portion 3	Transnet	T1107/1992
Portion 4	Hotazel Manganese Mines (Pty) Ltd	T338/2009
Rissik 330		
Portion 0	Gideon Poolman Familie Trust	T3211/2015

Portion	Landowner	Title deed number
Portion 1	Terra Nominees (Samancor Manganese)	T2395/1996
Portion 2	Transnet	T515/1992
Portion 3	United Manganese of Kalahari Pty Ltd	T2092/2009
Goold 329		
Portion 1	Kruger Machiel Andries	T399/1977
Portion 2	Kruger Nicolaas Philippus Fourie	T455/2010
Portion 5	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 6	Gideon Poolman Familietrust	T3211/2015
Portion 8	Transnet	T515/1992
Portion 9	Hotazel Manganese Mines (Pty) Ltd	T2821/2011
Shirley 367		
Portion 0	Leatitia Penny Trust	T3464/1997
Portion 1	Annalien Elizabeth Fourie	T730/1984
Portion 2	Pretorius Hester Johannes	T718/1979
Portion 3	Transnet	T43/1993
Smartt 314		
Portion 0	Terra Nominees (Samancor Manganese)	T2396/1996
Portion 1	Transnet	T221/1966
Alton 368		
Portion 0	Booysen Jacomina Maria	T285/1979
Portion 1	Andries Matthys Duvenhage Testamentere	T905/2009
Milner 327		
Whole Farm	Kruger Machiel Andries	T26/1931

Land claims

The Northern Cape Department of Rural Development and Land Reform: Land Claims Commissioner was contacted to confirm if any land claims have been lodged on portion 8, 16, 17 and 18 of the farm Mamatwan 331 and the remaining extent of the farm Moab 700. The Land Claims Commissioner has confirmed that no land claims have been lodged on these farms. Proof of correspondence is included in Appendix D.

Land within the Tshipi Borwa mine surface and mining right boundaries

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

Land use surrounding the Tshipi Borwa mine

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

Agriculture

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

Isolated residence/ residential area

With reference to Figure 14, the nearest formally demarcated residential areas to the Tshipi Borwa Mine include:

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

There are sparsely situated residences and farmhouses on the surrounding farms. These are owned and/or occupied by farmers and farm workers and include:

- Farm workers residence located on the farm Middelplaats 332 located approximately 2 km north west from the mine (Figure 15);
- A permanent farm homestead (A. Pyper) located on the farm Middelplaats 332 approximately 2 km west of the mine (Figure 14);
- A permanent farm homestead (Andries van den Berg) located on the farm Mamatwan 331 approximately 1 km south west of the mine (Figure 15); and
- A permanent farm homestead (Nic Fourie) located on the farm Shirley 367 approximately 1.5 km south of the mine (Figure 15).

No informal settlements are located in immediate proximity to the Tshipi Borwa Mine.

Infrastructure and servitudes

The Eskom Adams/Kalbas 132 kV powerline is located to the east of the Tshipi Borwa Mine, alongside the R380 district road between Hotazel to Kathu (see Figure 14).

The Sedibeng Vaal-Gamagara water supply pipeline supplies the Tshipi Borwa Mine with process and potable water. A pipeline connection to the Sedibeng Vaal-Gamagara reservoir is located approximately 500m east of the Tshipi Borwa mine (see Figure 14).

The Transnet railway line that services the mines of the Kalahari Basin, from Black Rock in the north to Mamatwan and Tshipi in the south passes to the east of Tshipi Borwa Mine with a private siding onto the mine from where ore is loaded and despatched for export (see Figure 14).

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

Surrounding mines

Various other mining operations located in the immediate vicinity of the Tshipi Borwa Mine include (Figure 14):

- The United Manganese of Kalahari Mine (United Manganese of Kalahari (Pty) Ltd) – Located approximately 2 km north east from the nearest section of the surface use area;
- The Mamatwan Mine (South32 (Pty) Ltd) – Located directly adjacent to the eastern boundary of the surface use area);
- The old Middelplaats Mine (dormant/closed) – located approximately 1.6 km north west from the nearest section of the surface use area;
- The old Adams Mine (dormant/closed) – Located approximately 600 m east of the nearest section of the surface use area; and
- The Sebilo Mine (Sebilo Resources (Pty) Ltd) – Located approximately 7.6 km north from the nearest section of the surface use area

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

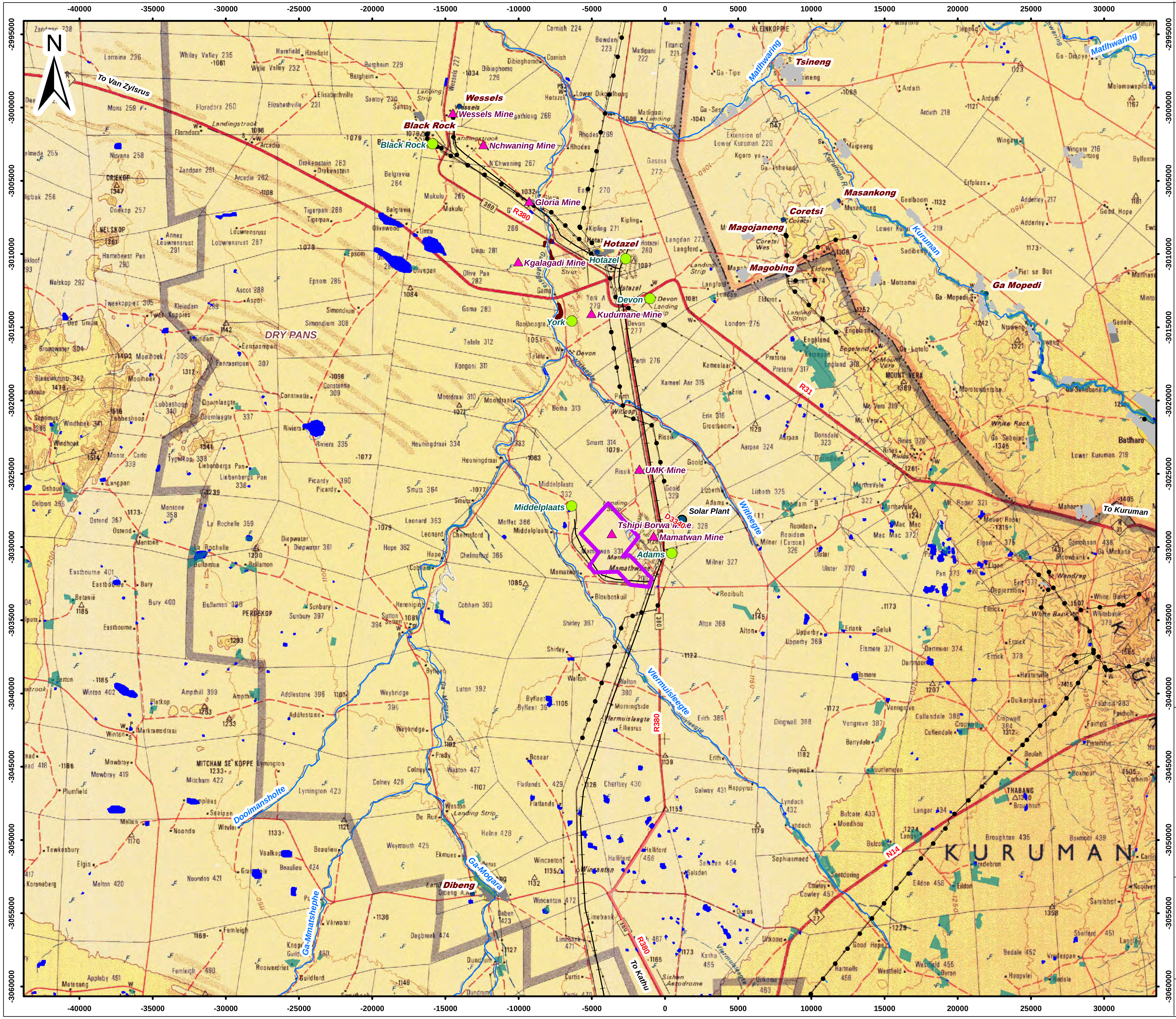
- The Gloria Mine (Assmang (Pty) Ltd) – Located approximately 20 km north from the nearest section of the surface use area;
- The Kalagadi Mine (Kalagadi Manganese (Pty) Ltd) – Located approximately 18 km north west form the nearest section of the surface use area;
- The Kudumane Mine (Kudumane Manganese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

Solar plant

The Adams Solar Plant (Adams Solar PV Project Two (Pty) Ltd) owned by Enel Green Power (Pty) Ltd is situated approximately 3km north east from the mining area and is located on the farm Adams 328. The Adams Solar Plant will aid the new renewable generation capacity of the national grid and contribute to the 42% share targeted by the Department of Energy for renewable energy (Integrated Resource Plan, 2010-2030). According to the strategy, 8.4 GW of new generation capacity in South Africa will be obtained from the Adams Solar Plant over the next twenty years.

CONCLUSION

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



Legend

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

0 4 8 Kilometers

Scale: 1:250 000 @ A3

Projection: Transverse Mercator
Datum: Hartebeesthoek, Lo 23

Tshipi é Ntle Manganese Mining (Pty) Ltd

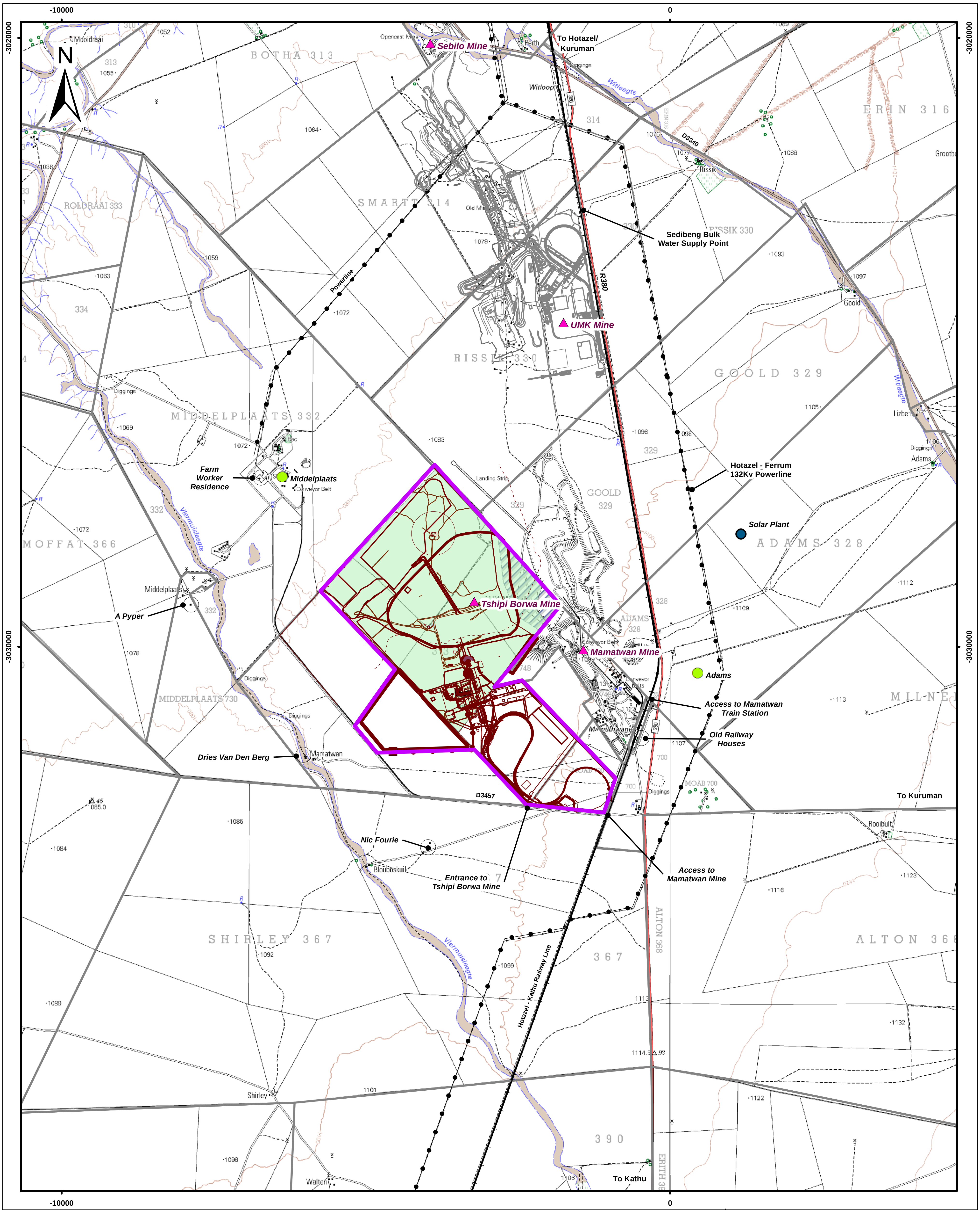
Figure 14

Regional Land Use Map

SLR

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

710.20029.00008	2019/07/31



Legend

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

0 1 000 2 000 Meters

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

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 15

Local Land Use

SLR

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

710.20008.00041 | 2019/07/31

7.4.3 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

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

- The area is characterised by hot summer temperatures, colder winter temperatures, low rainfall and high evaporation rates;
- Soils at the Tshipi Borwa Mine are well-drained sandy soil, which allows for high infiltration rates and low organic content and is highly erodible. The soil fertility is low due to a deficiency in key nutrients, such as phosphorus. Soil located at the mine has low agricultural potential due to the low rainfall. The natural capability of the land has already been influenced by existing mining infrastructure and activities;
- The Tshipi Borwa Mine is located in the Kathu Thornveld habitat. Protected tree species at the mine in the Camel Thorn (*Vachellia erioloba*) and the Grey Camel Thorn (*Vachellia haemotoxylon*) which are protected under the NFA. The site is associated with areas of medium high and medium low sensitivity habitat units. It is important to note that the natural biodiversity on and surrounding the mine has already been influenced by existing mining activities and infrastructure;
- No watercourses or wetlands are located at the Tshipi Borwa Mine;
- Groundwater quality had been influenced by anthropogenic pollution from farming and on-site and surrounding mining activities;
- Air quality, noise and aesthetics within and surrounding Tshipi Borwa Mine has already been influenced through the presence of mining activities and associated infrastructure.;
- There is a low possibility of palaeontological resources occurring at the mine. No heritage/cultural resources are located at the Tshipi Borwa Mine;
- The notable infrastructure surrounding the Tshipi Borwa Mine includes roads (R380), a railway line, powerline and a water pipeline (Vaal Gamagara); and
- The area surrounding the mine is sparsely populated and is characterised by isolated farmsteads located within a 1 km radius of the mine, with the closest formal residential area (Hotazel) located approximately 18 km from the mine. The areas surrounding the mine have also been influenced by surrounding dormant and active mines and a solar farm.

7.4.4 ENVIRONMENT AND CURRENT LAND USE MAP

A conceptual map showing topographical information as well as land uses on and immediately surrounding the Tshipi Borwa Mine is provided in Figure 14 and Figure 15.

7.5 ENVIRONMENTAL IMPACTS AND RISKS OF THE ALTERNATIVES

This section provides a list of potential impacts on environmental and socio-economic aspects that have been identified in respect of each of the main project actions/activities and processes for each of the alternatives considered. The ratings for consequence, probability and significance of each of the impacts in the **unmitigated scenario** (which assumes that no consideration is given to the prevention or reduction of environmental and social impacts) are also provided in the table below in accordance with the Northern Cape DMR report template. The four options include: **Option 1** (complete backfill), **Options 2** (Partial backfill), **Option 3** (Concurrent backfill only (In-pit dumping)) and **Option 4** (No backfill).

TABLE 7-21: LIST OF IMPACTS IDENTIFIED FOR THE PROPOSED PROJECT INCLUDING ALTERNATIVES

The assessment ratings provided in this table are for the unmitigated scenario only which assumes that no consideration is given to the prevention or reduction of environmental and social impacts.

Potential impact	Alternative	Main project activity	Project phase	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
Loss and sterilisation of mineral resources	1 - 2	• Completely backfilled (option 1) and partially backfilled open pit (option 2) • Waste rock dumps remaining on surface – albeit smaller and limited	Closure	H	H	H	H	H	Cannot be reversed with mitigation	Will cause sterilisation of a deeper (underground) resource as it cannot be accessed off the highwall and is uneconomical to access through a shaft. Access to the waste rock resource as a source of building material will be difficult.	Cannot be manged/mitigated to acceptable levels
	3	• Partially open pit (result of concurrent backfill only i.e. in-pit dumping) • Waste rock dumps remaining on surface		L+	H	H	M	M+	Can be reversed with mitigation	Will not cause sterilisation of the deeper (underground) resource. Even with poor planning and placement of rock into the pit, access to the deeper (underground) resource could still be achieved but reduces the related efficiencies.	Can be manged/mitigated to acceptable levels
	4	• Open pit • Waste rock dumps remaining on surface		L+	H	H	H	H+	Can be reversed with mitigation	Will not cause irreplaceable loss of a resource. Easy access to the underground mining resources.	Can be manged/mitigated to acceptable levels
Hazardous excavations and infrastructure (Safety to third parties and animals)	1	• Decommissioning activities • Waste rock dumps remaining on surface (albeit limited)	Decommissioning Closure	H	H	H	H	H	Loss or injury to third parties or animals cannot be reversed	Irreplaceable loss in the event of loss of third party or animals	Can be manged/mitigated to acceptable levels
	2 - 3	• Decommissioning activities • Partially open pit (result of partial and in-pit dumping) • Waste rock dumps remaining on surface - albeit limited for option 2		H	H	H	H	H			
	4	• Decommissioning activities • Open pit • Waste rock dumps remaining on surface		H	H	H	H	H			
Loss of soil and land capability through contamination and physical disturbance	1	• Decommissioning activities • Waste rock dumps remaining on surface – albeit limited • Final surface land forms	Decommissioning Closure	H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
	2 - 3	• Decommissioning activities • Waste rock dumps remaining on surface – albeit limited for option 2 • Partially open pit (result of partial and in-pit dumping) • Final surface land forms		H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
	4	• Decommissioning activities • Waste rock dumps remaining on surface • Open pit • Final surface land forms		H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
Physical destruction of biodiversity	1 - 2	• Decommissioning activities • Completely (option 1) and partially backfilled open pit (option 2)	Decommissioning Closure	H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels

Potential impact	Alternative	Main project activity	Project phase	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
		• Waste rock dumps remaining on surface – albeit limited									
	3	• Decommissioning activities • Open pit void (result of in-pit dumping) • Waste rock dumps remaining on surface		H	H	M	H	H	Can be reversed and enhanced with access to a pit lake	Possible	Can be manged/mitigated to acceptable levels
	4	• Decommissioning activities • Open pit • Waste rock dumps remaining on surface		H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
General disturbance of biodiversity	1 - 2	• Decommissioning activities • Completely (option 1) and partially backfilled open pit (option 2) • Waste rock dumps remaining on surface – albeit limited	Decommissioning Closure	H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
	3	• Decommissioning activities • Open pit void (result of in-pit dumping) • Waste rock dumps remaining on surface		H	H	M	H	H	Can be reversed and enhanced with access to a pit lake	Possible	Can be manged/mitigated to acceptable levels
	4	• Decommissioning activities • Open pit • Waste rock dumps remaining on surface		H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
Alteration of natural drainage patterns	1	• Waste rock dumps remaining on surface – albeit limited	Closure	M	H	M	L	M	Can be reversed at closure	Possible	Can be manged/mitigated to acceptable levels
	2	• Partially open pit (result of partial backfilling) • Waste rock dumps remaining on surface – albeit limited		M-L	H	M	L	M-L	Can be reversed at closure	Possible	Can be manged/mitigated to acceptable levels
	3	• Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface		M-L	H	M	L	M-L	Cannot be reversed for the pit	Will cause negligible loss of water to the catchment flow that is collected in the pit. However, collection of rainfall and run-off in the partially open pit does contribute to the development of the pit lake which can be used for alternative uses.	Cannot be avoided/mitigated for the pit
	4	• Open pit • Waste rock dumps remaining on surface		M-L	H	M	L	M-L			
Contamination of surface water resources	1 - 2	• Decommissioning activities • Waste rock dumps remaining on surface – albeit limited	Decommissioning Closure	H	H	M	M	M	Can be reversed with mitigation	Unlikely to cause irreplaceable loss even in the unmitigated scenario given that the Vlermuisleegte is located 2 km west of the mine and it is unlikely that pollution sources will reach surface water resources.	Can be managed/mitigated to acceptable levels
	3 - 4	• Decommissioning activities • Partially open pit (access to pit lake) • Waste rock dumps remaining on surface		H	H	M	H	H	Can be reversed with mitigation	Possible in the unmitigated scenario, as the pit lake will become a surface water resource this is contaminated.	Can be managed/mitigated to acceptable levels
Lowering of groundwater levels	1 – 2	• Cessation of dewatering activities	Decommissioning Closure	Not applicable as groundwater levels will rebound to natural groundwater level.					Not applicable		Can be mitigated in the unlikely event of loss to third party borehole users.
	3 - 4	• Cessation of dewatering activities	Decommissioning Closure	Not applicable as groundwater levels at third party boreholes will rebound to natural groundwater level.					Not applicable		
Contamination of groundwater resources	1 and 2	• Waste rock backfilled into the open pit (part of	Closure	L	H	L	L	L	Cannot be	Unlikely to cause irreplaceable loss of	Can be manged to

Potential impact	Alternative	Main project activity	Project phase	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
		complete (option 1) and partial backfilling (option 2) • Waste rock dumps remaining on surface – albeit limited							reversed	a resource as the predicted pollution plume does not extend to third party boreholes.	acceptable levels
	3	• Waste rock backfilled into the open pit (part of in-pit dumping) • Waste rock dumps remaining on surface		L	H	L	L	L		Unlikely to cause irreplaceable loss of a resource as the predicted pollution plume does not extend to third party boreholes. Option 3 and 4 also act as a sink which minimises the extent of the pollution plume.	
	4	• Waste rock dumps remaining on surface		L	H	L	L	L			
Air pollution	1 - 4	• Waste rock remaining on surface	Closure	L	H	L	L	L	Partially reversible	Unlikely	Can be manged/mitigated to acceptable levels
Disturbing noise levels	1	The possibility of generating both noise disturbances and noise nuisance was limited to all mine phases prior to closure and as such this option is not associated with post closure noise.							Not applicable as no post closure noise will be generated		
	2 - 4	• Monitoring, aftercare and maintenance	Closure	L	M	L	L	L	Cannot be reversed	Possible	Can be manged/mitigated to acceptable levels
Negative visual views	1 - 2	• Decommissioning activities • Completely (option 1) and partially backfilled open pit (option 2) • Waste rock dumps remaining on surface – albeit limited	Decommissioning Closure	M	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
	3 - 4	• Decommissioning activities • Partially open pit (option 3) • Open pit (option 4) • Waste rock dumps remaining on surface	Decommissioning Closure	M	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
Road disturbance and traffic safety	1 – 4	• Monitoring, aftercare and maintenance	Closure	The proposed project will not generate additional traffic and as such project-related road disturbance and traffic safety impacts are not expected to occur. This impact has therefore been rated as being insignificant.					Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels
Loss of heritage/cultural and palaeontological resources	1 – 4	• Completely (option 1) and partially backfilled open pit (option 2) • Partially open pit (option 3) • Open pit (option 4) • Waste rock dumps remaining on surface (albeit limited for options 1 -2)	Closure	Not applicable as not heritage/cultural resources located on site and there is a low possibility of palaeontological resources occurring in the area.					In the unlikely event of a loss of these resources, the loss cannot be reversed	In the unlikely event of a loss of these resources, this will cause irreplaceable loss	Can be avoided through chance find procedures
Inward migration	1 - 4	The potential for increased social risks is considered to be negligible for the proposed project. This impact has therefore been rated as being insignificant.							Not applicable	Not applicable	Can be manged/mitigated through existing management procedures
Economic impact	1 - 2	• Decommissioning activities • Completely (option 1) and partially backfilled open pit (option 2) • Waste rock dumps remaining on surface (albeit limited for options 1 and 2)	Decommissioning Closure	H	H	M	M	H	Cannot be reversed with mitigation	Causes irreplaceable sterilisation of deeper (underground) resource located to the north of the open pit	Cannot be manged/mitigated to acceptable levels
	3 - 4	• Decommissioning activities • Partially open pit (option 3) • Open pit (option 4)		M+	H	M	H	H+	Can be reversed with mitigation	Unlikely to cause irreplaceable sterilisation of the deeper resource as a change to the closure objective allows for the access to future	Can be enhanced with management/mitigated measures

Potential impact	Alternative	Main project activity	Project phase	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
		• Waste rock dumps remaining on surface								underground resources	
Change in land use	1 - 4	• Decommissioning activities • Completely (option 1) and partially backfilled open pit (option 2) • Partially open pit (option 3) • Open pit (option 4) • Waste rock dumps remaining on surface (albeit limited for options 1 -2)	Decommissioning Closure	H	H	M	H	H	Can be reversed with mitigation	Possible	Can be manged/mitigated to acceptable levels

7.6 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The method used for the assessment of environmental issues is set out in Table 7-22. This assessment methodology enables the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

TABLE 7-22: IMPACT ASSESSMENT METHODOLOGY

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

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

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

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

SEVERITY = M

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

SEVERITY = H

DURATION	Long term	**H**	**High**	**High**	**High**

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

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

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

7.7 POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

A basic alternatives analysis selection matrix was compiled in order to provide a discussion of each of the alternatives considered. Table 7-23 presents the results the options analysis. The ranking system is a simple four score relative ranking system. For each criterion, a score of one is allocated to the best option and a score of four to the worst. The option with the lowest total score is the preferred option. Where specialist input was obtained in order to provide input into the options analysis this has been indicated in the table below. **Results of the alternatives options analysis indicate that there preferred alternative is option 3: concurrent backfill only (In-pit dumping).**

TABLE 7-23: ALTERNATIVE ANALYSIS MATRIX

Aspect	Complete backfill – option 1		Partial backfill – option 2		Concurrent backfill only (In-pit dumping) – option 3		No backfill -option 4	
	Detail	Rating	Detail	Rating	Detail	Rating	Detail	Rating
Environmental								
Terrestrial biodiversity* (Included in Appendix G)	The advantage of complete backfill is that it best reinstates the natural conditions due to: • Reinstatement of the landscape to grazing/wilderness, • Re-introduction of protected species; and • Re-establishment of a terrestrial habitat for faunal species that were displaced and recreates habitat connectivity. The disadvantage is that this alternative may however: • Create a single habitat, and does not maximising biodiversity potential particularly when the original biodiversity is unlikely to ever be fully reinstated; and • Does not allow for the natural carrying capacity to be truly reinstated to pre-mining levels.	2	The advantage of partial backfill is that this allows for the reinstatement of the natural conditions due to: • Re-introduction of protected species; and • Revegetation and rehabilitation will allow for the provision of terrestrial habitat for faunal species displaced as a result of mining activities. The disadvantage is that this alternative may however: • Result in the remnants of mining activities on surface (eg. waste rock dumps); • Create a single habitat, and does not maximising biodiversity potential particularly when the original biodiversity is unlikely to ever be fully reinstated; • Does not allow for the natural carrying capacity to be truly reinstated to pre-mining levels. • Limitations to habitat connectivity reinstatement; • Require monitoring of indigenous vegetation rehabilitation success.	3	The advantage of concurrent backfill only (In-pit dumping) is that this allows for the partial reinstatement of the natural conditions and provides a water source that allows for: • The creation of a multiple areas of habitat for utilisation through landscape reshaping and soil profiling; • The creation of the pit lake will result in an increased habitat diversity, thereby stimulating an increase in faunal and floral species diversity; • Potential source of drinking water for animals; and • Creation of a new biodiversity hotspot, species breeding grounds and a source from which species could repopulate surrounding habitats (sinks). The disadvantage is that this alternative may however: • Result in the remnants of mining activities on surface (eg. waste rock dumps); • Require an extended timeline until the pit lake is created and functioning versus that of complete backfill habitat creation; and	1	The disadvantage of no backfilling is that this does not provide an opportunity that would benefit the local ecology or environment due to: • Too steep to access the pit lake water for the creation of aquatic habitat • Remnants of mining activities on surface (eg. waste rock dumps) increasing latent footprint of impacts. Most waste rock on surface for this alternative; • No terrestrial habitat enhancement post closure due to lack of access to pit lake water; and • The highest levels of residual impacts to ecology. An example of the above would be the Kimberly Big Hole, which should be avoided.	4
Aquatic biodiversity* (Included in Appendix G)	The disadvantage of complete backfill is the lost opportunity to create a surface water feature that could be used to increase aquatic biodiversity.	2	The disadvantage of partial backfill is the lost opportunity to create a surface water feature that could be used to increase aquatic biodiversity.	2	The advantage of concurrent backfill only (In-pit dumping) is that this allows for: • The pit lake be designed in such a way as to have extensive shallow areas and have some productivity which can support a level of biodiversity; • The pit lake can be designed in such a way as to maximise habitat diversity and create areas where fish and other aquatic biota can successfully spawn; and • The opportunity to create a surface water feature that can increase (although artificially) biodiversity and especially aquatic biodiversity in the area.	1	The disadvantage of no backfilling is that this does not provide an opportunity that would benefit the local ecology or environment due to: • The lost opportunity to create a surface water feature that can increase (although artificially) biodiversity and especially aquatic biodiversity in the area since the pit lake will be deep with steep sides and little habitat diversity; and • The water will be well below natural ground level and therefore isolated from the surrounding less affected environment.	4

Aspect	Complete backfill – option 1		Partial backfill – option 2		Concurrent backfill only (In-pit dumping) – option 3		No backfill -option 4	
Soils and land capability* (Included in Appendix F)	The disadvantage is that a pit lake will not develop if the open pit is completely backfilled and as such no water will be easily available for the use of agricultural productivity and is therefore considered the least preferred option.	4	The disadvantage is that a pit lake will not develop if the open pit is completely backfilled and as such no water will be easily available for the use of agricultural productivity and is therefore considered the least preferred option.	4	The advantage of concurrent backfill only (In-pit dumping) is that it will have the second-highest volume of water readily available within the open pit that can be utilised for agricultural productivity. The water quality issues are not considered in this category.	2	The advantage of no backfill is that the most water that will be easily available for use of agriculture productivity, and it is also the option that will provide the highest agricultural productivity per unit area. The water quality issues are not considered in this category.	1
Pit lake* (Included in Appendix H)	The advantage of completely backfilling the open pit is that it will take approximately 39 years to fill to the quasi-static water levels which support faster groundwater rebound levels in the cone of depression. The disadvantages of completely backfilling the open pit include: • No pit lake will develop and as such boreholes would need to be drilled to access the water; • The groundwater level will rebound to nature ground water levels, however flow through the backfilled pit means contamination plumes will move to wider groundwater system; • Complete backfill does not allow for a pit lake to form and as such generates a pore water chemistry in the waste rock. This is due to no evaporation undertaken or groundwater flow through and the infill rate is faster than those options which include a pit lake. Therefore this is likely to underestimate the concentration of the chemistry in the pore water. The water is only usable for 25 years without treatment. The parameter that fails the DWS livestock watering limits includes Fe from year 25.	2	The advantage for partially backfilling the open pit is that it will take approximately 36 years to fill to the quasi-static water levels which support faster groundwater rebound levels in the cone of depression. The disadvantages of partially backfilling the open pit include: • No pit lake will develop and as such boreholes would need to be drilled to access the water; • The groundwater level will rebound to nature ground water levels, however flow through the backfilled pit means contamination plumes will move to wider groundwater system; • Partial backfill does not allow for a pit lake to form and as such generates a pore water chemistry in the waste rock. This is due to no evaporation undertaken or groundwater flow through and the infill rate is faster than those options which include a pit lake. Therefore this is likely to underestimate the concentration of the chemistry in the pore water. The water is only usable for 25 years without treatment. The parameter that fails the DWS livestock water limit includes Fe from year 25.	2	The advantage of concurrent backfill only (in-pit dumping) includes: • A pit lake will develop and as such this provides access to future readily available water that can be used to promote alternative land uses; • Less infrastructure will be required to abstract water as boreholes will not be required; • No pit spilling; • The groundwater level in surrounding boreholes will rebound but a cone of depression will remain on site because the open pit will act as a sink. Hydraulic sinks means that the cone of depression captures wider pollution plumes from other mine areas and sources. • In terms of water quality, modelling shows that this water can be used without treatment for the longest period of all for options (approximately 100 years). Moreover, with successfully implemented floating wetlands the water is usable for livestock watering and biodiversity for at least 200 years. The disadvantage of concurrent backfilling only (in-pit dumping) includes: • It will take approximately 153 years to fill to the quasi-static water levels; • Water quality will meet livestock watering limits for 100 years, thereafter treatment will be required, by means of floating wetlands.	1	The advantages of not backfilling the open pit includes: • A pit lake will develop and as such this provides access to future readily available water that can be used to promote alternative land uses; • Less infrastructure will be required to abstract water as boreholes will not be require; • It will take approximately 46 years to fill to the quasi-static water levels; • No pit spilling; • The groundwater level in surrounding boreholes will rebound but a cone of depression will remain on site because the open pit will act as a sink. Hydraulic sinks means that the cone of depression captures wider pollution plumes from other mine areas and sources. The disadvantages of not backfilling the open pit includes: • This closure option, with a pit lake and no infill is the least favoured option from a water chemistry perspective. The main reason is that there is no waste rock in the pit to aid the water precipitate of some of the parameters such as metals. Modelling results show that the water quality will start to deteriorate due to evapo-concentrations from year 50 before treatment is required.	4
Air* (Included in Appendix I)	From an advantage and disadvantage perspective there is no difference between the closure alternatives as each options presents final land forms or exposed areas that have the potential to contribute to air pollution.	1	From an advantage and disadvantage perspective there is no difference between the closure alternatives as each options presents final land forms are exposed areas that have the potential to contribute to air pollution.	1	From an advantage and disadvantage perspective there is no difference between the closure alternatives as each options presents final land forms are exposed areas that have the potential to contribute to air pollution.	1	From an advantage and disadvantage perspective there is no difference between the closure alternatives as each option presents final land forms are exposed areas that have the potential to contribute to air pollution.	1
Noise* (Included in Appendix J)	From an advantage and disadvantage perspective there is no difference between the closure alternatives	1	From an advantage and disadvantage perspective there is no difference between the closure alternatives	2	From an advantage and disadvantage perspective there is no difference between the closure alternatives	2	From an advantage and disadvantage perspective there is no difference between the closure alternatives	2
Visual* (Included in Appendix K)	The approved EMPr's (SLR, August 2017 and April 2019) commits Tshipi to restore the surface to pre-mining state of wilderness and grazing and	3	This alternative will result in waste material being left on the surface, however this alternative allows for some rehabilitation (albeit limited) before the end of mine (i.e.	2	This alternative will result in waste material being left on the surface, however this alternative allows for progressive rehabilitation before the end of	1	This alternative will result in waste material being left on the surface, however this alternative allows for progressive rehabilitation before the end of mine (i.e.	1

Aspect	Complete backfill – option 1		Partial backfill – option 2		Concurrent backfill only (In-pit dumping) – option 3		No backfill -option 4	
	requires that the open pit is backfilled. This alternative entails a complete backfill of the final pit void post mining before rehabilitation of the surface can take place. However, even with a complete backfill, because of the bulking factor, there will be waste material on the surface that would need to be rehabilitated but only after mining is completed.		sloping and rehabilitation of waste rock dumps remaining on the surface). This is a slight advantage as during the life of mine some rehabilitation (albeit limited as limited waste rock will remain on surface) can take place allowing for best practice to take place and ensure that this process is well managed and will achieve the best rehabilitation effects.		mine (i.e. sloping and rehabilitation of waste rock dumps remaining on the surface). This is an advantage as during the life of mine rehabilitation can already take place allowing for best practice to take place and ensure that this process is well managed and will achieve the best rehabilitation effects.		sloping and rehabilitation of waste rock dumps remaining on the surface). This is an advantage as during the life of mine rehabilitation can already take place allowing for best practice to take place and ensure that this process is well managed and will achieve the best rehabilitation effects. The disadvantage of this option is that larger and possibly more dumps will be required post closure.	
Socio-economic								
Economic contribution* (included in Appendix L)	Completely backfilling the open pit will take place over a period of 25.7 years, utilising a conveyor system which will comprise front end loaders moving overburden material onto grizzly feeders that are connected to a movable conveyor system. In this regard the advantage of completely backfilling the open pit is it will stimulate the national, local and regional economy with an approximate amount of R1.21 billion over approximately 25.7 years in operational spending as well as an initial capital investment of R82.9 million. The employment value will constitute R61.7 million (PV) for 25 employment opportunities. However this expenditure will be a net outflow of costs for the company and will be at the expense of tax collection. Once the pit has been rehabilitated, grazing activities may be able to resume. For the fully rehabilitated area this will result in a potential revenue of R1.18m over a period of 55 years (time line life of mine including underground mining). Labour will amount to R2.55 million (PV) for 55 years. Aggregate crushing activities may be able to continue for a limited number of years depending on market demand for all four options. Should the pit be fully backfilled, access to the underground resources will not be feasible because it requires the establishment of a vertical shaft system from surface. Backfilling the pit completely will result in a lost capital investment injection of R1.5 billion (PV) discounted over 24 years. Furthermore a potential revenue boost of R21.2 billion (PV) as well as 246 job opportunities to a value of R5.7 billion (PV) over the life of mine will be lost to loss the local, regional and national	4	Partial backfilling of the open pit will take place using conveyors over 15.4 years. Partial backfilling the Tshipi open pit will stimulate the national, local and regional economy with an approximate amount of R1.023 billion over approximately 15.4 years in operational spending as well as an initial capital investment of R82.9 million. The employment value will constitute R51.9 million (PV) for 25 employment opportunities over 15.4 years. However this expenditure will be a net outflow of costs for the company and will be at the expense of tax collection. Once the pit has been partially rehabilitated, grazing activities may be able to resume on available land. For the rehabilitated areas this will result in a potential revenue of R1.0m over a period of 55 years. Labour will amount to R2.1million (PV). Aggregate crushing activities may be able to continue for a limited number of years depending on market demand for all four options. Should the pit be partially backfilled, access to the underground resources will not be feasible because it requires the establishment of a vertical shaft system from surface. Partially backfilling the pit will result in a lost capital investment injection of R1.5 billion (PV) discounted over 24 years. Furthermore potential revenue boost of R21.2 billion (PV) as well as 246 job opportunities to a value of R5.7 billion (PV) over the life of mine will be lost to loss the local, regional and national economy. From a net economic perspective, the economy will lose an estimated value of more than R21.7 billion on a national regional and local level.	3	Not undertaking backfilling activities will result in a lost capital investment injection of R82.9 million over a period of 5 years. Furthermore, not backfilling will result in a loss of operational expenditure to the value of R1.21 billion (PV), of which the employment values constitute R61.7 million in present value terms. Not rehabilitating the open pit area, will result in a loss of grazing land due to the pit and waste rock dumps on surface. Only a small portion of land will be available for grazing. For the rehabilitated areas this will result in a potential revenue of R290 593 over a period of 55 years. Labour will amount to R634 236 (PV). Aggregate crushing activities may be able to continue for a limited number of years depending on market demand. Only undertaking in-pit dumping provides access to the underground resources via the un-rehabilitated open pit area. Accessing underground resources via the open pit area will require a life of mine capital investment R1.5 billion (PV) discounted over 24 years. This will result in a revenue boost of R21.2 billion (PV) over the life of mine. The mine will able to provide 246 job opportunities to a value of R5.7 billion (PV) over the life of mine. From a net economic perspective, the national, regional and local economies will gain more than R21.5 billion from the mining of underground resources when partial backfilling is considered.	2	Not undertaking backfilling activities will result in a lost capital investment injection of R 82.9 million over a period of 5 years. Furthermore, not backfilling will result in a loss of operational expenditure to the value of R1.21 billion (PV), of which the employment values constitute R61.7 million in present value terms. Not rehabilitating the open pit area, will result in a loss of grazing land due to the pit and waste rock dumps on surface. Only a small portion of land will be available for grazing. For the rehabilitated areas this will result in a potential revenue of R144 427 over a period of 55 years. Labour will amount to R313 963 (PV). Aggregate crushing activities may be able to continue for a limited number of years depending on market demand. Not backfilling the pit provides access to the underground resources via the unrehabilitated open pit area. Accessing underground resources via the open pit area will require a life of mine capital investment R1.5 billion (PV) discounted over 24 years. This will result in a revenue boost of R21.2 billion (PV) over the life of mine. The mine will able to provide 246 job opportunities to a value of R5.7 billion (PV) over the life of mine. From a net economic perspective, the national, regional and local economies will gain an estimate R21.5 billion from the mining of underground resources when no backfilling is considered.	1

Aspect	Complete backfill – option 1		Partial backfill – option 2		Concurrent backfill only (In-pit dumping) – option 3		No backfill -option 4	
	economy. From a net economic perspective, the economy will lose an estimated value of more than R 21.4 billion on a national regional and local level.							
Legal								
Authorisations	No environmental authorisation will be required to be obtained in order to proceed, as this alternative is already authorised in terms of the approved EMPr's (SLR, August 2017 and April 2019).	1	Approval of the BAR is required from the DMR to change the current closure commitment to partial backfilling.	2	Approval of the BAR is required from the DMR to change the current closure commitment to concurrent backfilling only (In-pit dumping).	2	Approval of the BAR is required from the DMR to change the current closure commitment to no backfilling.	2
Technical								
Property and locality	The proposed project will take place within the approved mining right and surface use area. There is no difference between the various alternatives from a property and locality perspective. There is no advantage or disadvantage between the alternatives.	1	The proposed project will take place within the approved mining right and surface use area. There is no difference between the various alternatives from a property and locality perspective. There is no advantage or disadvantage between the alternatives.	1	The proposed project will take place within the approved mining right and surface use area. There is no difference between the various alternatives from a property and locality perspective. There is no advantage or disadvantage between the alternatives.	1	The proposed project will take place within the approved mining right and surface use area. There is no difference between the various alternatives from a property and locality perspective. There is no advantage or disadvantage between the alternatives.	1
Type of activity	The disadvantage of this alternative is that activities post closure will be limited to grazing as there is not access to a pit lake to promote the use of alternative land uses.	4	The disadvantage of this alternative is that activities post closure will be limited to grazing as there is not access to a pit lake to promote the use of alternative land uses.	4	Due to the access to the pit lake, activities that could take place post closure include aquaponics, intensive farming, and recreational fishing. This is supported by a functional pit lake with desired water quality.	1	Due to the access to the pit lake, activities that could take place post closure include aquaponics and intensive farming.	2
Design or layout	No alternatives were considered for the design or the layout of infrastructure and activities post closure.							
Rehabilitation programme	The disadvantage of complete backfill is that no concurrent rehabilitation of waste rock will take place given that the material will be placed back in the pit at closure and only then will the rehabilitation of the pit commence. In follows that rehabilitation will only commence in 2048.	4	Some concurrent rehabilitation of waste rock dumps can commence now, however this is limited to a small area as most of the rehabilitation will only commence after mining has been completed and pit is partially backfilled.	3	The advantage of concurrent backfilling only (in-pit dumping) is that concurrent rehabilitation of waste rock dumps can commence now.	1	The advantage of concurrent backfilling (in-pit dumping) is that concurrent rehabilitation of waste rock dumps can commence now, however the disadvantage is that this alternative also has the biggest dump footprint to rehabilitate.	2

Aspect	Complete backfill – option 1		Partial backfill – option 2		Concurrent backfill only (In-pit dumping) – option 3		No backfill -option 4	
Level of responsibility	Tshipi will be responsible for implementing the closure plan and will include post closure monitoring and aftercare obligations. In this regard the long term focus would be groundwater monitoring with shorter term monitoring and aftercare plan aspects focussed on groundwater levels, vegetation/ecosystem establishment, and erosion prevention. The advantage of this alternative is there will be a limited number of activities post closure that requires monitoring and management.	1	Tshipi will be responsible for implementing the closure plan and will include post closure monitoring and aftercare obligations. In this regard the long term focus would be groundwater monitoring with shorter term monitoring and aftercare plan aspects focussed on groundwater levels, vegetation/ecosystem establishment, and erosion prevention. The advantage of this alternative is there will be a limited number of activities post closure that requires monitoring and management.	1	Tshipi will be responsible for implementing the closure plan and will include post closure monitoring and aftercare obligations. In this regard, the long term focus would be on the pit lake where field implementation and monitoring is required to determine how successful the floating wetlands will be as a semi passive treatment solution. Moreover, ongoing monitoring, wetland maintenance/replacement, and establishment of shallow ecosystems may be required in the longer term to maintain the pit lake quality for livestock and ecology use. Alternatively, if the water quality fails at some point then alternative treatment technologies may need to be considered or the use of the pit lake and access thereto may have to change. The shorter term monitoring and aftercare plan aspects focussed on groundwater levels, vegetation/ecosystem establishment, and erosion prevention. The disadvantage of this alternative is that the post closure monitoring and aftercare maintenance is more extensive (more aspects that require monitoring) and the duration of the post closure obligations increase.	2	Tshipi will be responsible for implementing the closure plan and will include post closure monitoring and aftercare obligations. In this regard, the long term focus would be on the pit lake where field implementation and monitoring is required to determine how successful treatment solutions will be (most likely active treatment solutions). Moreover, ongoing monitoring and treatment may be required in the longer term to maintain the pit lake quality for livestock use. Alternatively, if the water quality fails the use of the pit lake and access thereto may have to change. The shorter term monitoring and aftercare plan aspects focussed on groundwater levels, vegetation/ecosystem establishment, and erosion prevention. The disadvantage of this alternative is that the post closure monitoring and aftercare maintenance is more extensive (more aspects that require monitoring) and the duration of the post closure obligations increase.	3
Commercial								
Operational aspects	The disadvantage of this alternative is the post operations use of a conveyor system to completely backfill the open pit which will cost approximately R1.21 billion over approximately 25.7 years in operational spending as well as an initial capital investment of R82.9 million.	4	The disadvantage of this alternative is the post operations use of a conveyor system to partially backfill the open pit which will cost approximately R1.023 billion over approximately 15.4 years in operational spending as well as an initial capital investment of R82.9 million..	3	The advantage of this option is that there is no post operations cost associated with backfilling the open pit as this is done concurrently with mining. Only pit high walls will need to be made safe by sloping and/or perimeter berms (could mostly be done as part of operations expenditure).	1	The disadvantage of this alternative is the significant cost associated with removing waste rock that has currently been backfilled into the open pit and placing this on the waste rock dumps on surface.	2
Totals		**34**		**32**		**21**		**31**

* Informed by specialist input

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

A summary of issues and concerns raised by I&APs during the BAR process is provided in Section 7.37.3. This section outlines possible mitigation measures, is provided in Table 7-24. The level of residual risk after management or alternatives that are available to accommodate or address issues and concerns raised by IAPs where relevant. In addition to this, this section will also provide an assessment of the impact or risks associated with the identified possible mitigation measures or alternatives. It is important to note that the table below only includes issues and concerns which can be addressed by mitigation and alternatives.

TABLE 7-24: POSSIBLE MANAGEMENT ACTIONS AND THE ANTICIPATED LEVEL OF RISK

Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation	
		Unmitigated	Mitigated
Can the open pit be backfilled after the underground mining is completed? This approach can be considered as an alternative to changing the backfill commitment.	The underground mine is marginal and if the attributable closure liability is included in the underground mine business plan then the business case may no longer be attractive. i.e. the deeper (underground) resource will be sterilised.	Not applicable	
As part of the alternative investigation, please also comment on the level of Tshipi's responsibility for the four closure options. Our department is of the opinion that with complete backfill, Tshipi's overall responsibility will be less than a closure option where biodiversity habitats are created that need to be maintained and monitored. As an overall comment, we will wait for the final Environmental Impact Assessment (EIA) and EMPr for the details around the specialist findings of the alternative investigation.	A discussion on alternatives to address this issue is included in Section 7.7. In this regard, it is important to note that there will be a closure phase monitoring and aftercare obligation in both the complete backfill (option 1) and concurrent backfill only (in-pit dumping) (being the preferred option) (option 3) scenarios. In this regard, post closure monitoring and aftercare maintenance is more extensive (more aspects that require monitoring) in option 3, and the duration of the post closure obligations increases from the preferred concurrent (in-pit dumping) alternative when compared to completely backfilling (option1). It is however important to note that the level of	Not applicable	

Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation	
	responsibility is only one aspect that was considered in the alternatives analysis as outlined in Section 7.5. In this regard when all environmental, social, technical (inclusive of level of responsibility), legal and commercial factors are considered as a whole, the preferred option is concurrent (in-pit dumping). Further to this, not proceeding with the project means that the pit will be completely backfilled and rehabilitated to an end state of grazing/wilderness and as such the economic spin-offs and biodiversity enhancements will not be realised.		
Why create a pit lake? Why don't you completely rehabilitate the whole pit? What will be the use of that water?	As part of the proposed project, the aim is to create a sustainable closure land use which is a combination of natural habitats creation (aquatic and terrestrial) and livestock watering with associated grazing potential. This can be achieved through access to water within the pit lake. If the pit is completely backfilled, it will not be possible to create a pit lake and the biodiversity enhancements will not be realised. These issues cannot be addressed through alternatives; however the proposed project promotes alternative land uses that would otherwise not be realised.	High	Medium+ to high+
The pit lake water will be contaminated because of the waste rock dumps? It will end up infiltrating to the groundwater. Will the water from the pit-lake be clean, will it not be contaminated?	• Implement the establishment of floating wetlands for the passive treatment of water quality within the pit lake as outlined in management action plan included in Section 26; and • In the unlikely event that borehole users experience any additional post closure mine related water loss, Tshipi will provide compensation, which could include an alternative water supply of equivalent water quality and quantity. This is included in the management action plan included in Section 26.	High	Low

Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation	
The most critical part in terms of this application will be the geohydrological report, which must cover the modelling of the plume and the monitoring boreholes (post closure monitoring) both near and downstream.	• Implementation of the monitoring programme outlined in Section 28. This includes post closure groundwater monitoring.	Low	Low
Please ensure that post closure monitoring is undertaken?			
In terms of protected trees and plants, how will the footprint differ from what's currently authorised? Will your dumps not increase in terms of surface area? Will they not have an impact on currently undisturbed areas?	• Obtain tree removal permits if any protected trees require removal. This is included in the management action plan included in Section 26.	High	Medium
So your current waste rock dumps are not rehabilitated?	• The proposed project allows for early rehabilitation of waste rock dumps as part of current mining operations. This is included in the management action plan included in Section 26.	High	High+
In terms of alternative land use on the permanent dumps, is it not possible to invite solar plant companies to place their solar panels on the permanent dumps instead of disturbing the natural veld next to the mine?	As part of the proposed project, the aim is to create a sustainable closure land use which is a combination of natural habitats creation (aquatic and terrestrial) and livestock watering with associated grazing potential. Additional concepts could be considered at some point as potential future additional land uses. This report has made provision for the consideration of establishing solar plants on the top of existing waste rock dumps as future additional land uses.	High	High+
In terms of your existing Environmental Authorisation, was there not something about offsets that Tshipi had to do? Is a biodiversity offset not already a condition in the Environmental Authorisation?	• Implement a biodiversity offset if requested by the Northern Cape DAFF. This is included in the management action plan included in Section 26.	High	Medium
But there's a sign that reads "Tshipi biodiversity offset area", I'm not sure whether it's still there?		High	Medium
As the proposed development is undergoing an EA Application process in terms of the National Environmental Management Act, 107 of 1998 (NEMA), NEMA Environmental Impact Assessment (EIA) Regulations for	• Implement chance find procedure in the unlikely event of any chance finds of heritage/ cultural or paleontological sites. This is included in the	Insignificant	

Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation
activities that trigger the Mineral and Petroleum Resources Development Act, No 28 of 2002 (MPRDA)(As amended), it is incumbent on the developer to ensure that a Heritage Impact Assessment (HIA) is done as per section 38(3) and 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). This usually includes an archaeological component, palaeontological component and any other applicable heritage components. The HIA must be conducted as part of the EA Application in terms of NEMA and the NEMA EIA. As the proposed development area is highly disturbed, the assessment to the impact of heritage may be reduced to a Letter of Recommendation of Exemption for further heritage studies in order to comply with section 38(8) of the NHRA. See www.asapa.co.za or www.aphp.org.za for specialists who will be able to provide such a report. The letter is referred to in the SAHRA 2007 Minimum Standards: Archaeological and Palaeontological Component of Impact Assessments.	management action plan included in Section 26.	Insignificant
The proposed development area is located within an area of moderate sensitivity as per the SAHRIS PalaeoSensitivity map. The BID notes that stromatolites may be present in the area. A desktop Palaeontological Impact Assessment must be undertaken to assess whether or not the development will impact upon palaeontological resources (please see https://www.palaeosa.org/heritage-practitioners.html for a list of palaeontological practitioners). The PIA must comply with the SAHRA 2012 Minimum Standards: Palaeontological Component of Heritage Impact Assessments. The appointed palaeontologist may also choose to submit a Letter of Recommendation for Exemption as noted in the 2012 Minimum Standards.		Insignificant
Any other heritage resources as defined in section 3 of the NHRA that may be impacted, such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must		Insignificant

Issue and concern raised	Possible management actions or alternatives to address issue	Impact significance of the possible management action before and after mitigation	
also be assessed			
Do you intend on rehabilitating the open pit?	• Rehabilitation of the pit is planned to ensure that a sustainable closure end land use which is a combination of natural habitats creation (aquatic and terrestrial) and livestock watering with associated grazing potential is achieved. This is included in the management action plan included in Section 26.	High	High+
How do you monitor air quality?	• Implement dust fallout monitoring programme. This is included in the management action plan included in Section 26.	Low	Low

7.9 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

This section is not applicable as alternatives were considered for the proposed project.

7.10 STATEMENT MOTIVATING THE PREFERRED ALTERNATIVE

The approved EMPr commits Tshipi to restore the surface to pre-mining state of wilderness and grazing and requires that the open pit is completely backfilled. Recent optimisation investigations indicate that when considering environmental, socio-economic, legal, commercial and technical, factors, completely backfilling the open pit is sub-optimal. Project alternatives that were considered included: complete backfill (option 1), partial backfill (option 2), concurrent backfill only (in-pit dumping) (option 3) and no backfill (option 4). The alternatives analysis (Refer to Section 7.7) has indicated that concurrent backfill only (in-pit dumping) is the optimal option. In broad terms, the preferred option allows for a closure solution and an alternative closure and rehabilitation strategy that offers:

- The opportunities for enhanced biodiversity habitats with a different backfill approach particularly in terms of topographic variety and access to surface water;
- The opportunities for enhanced land use increase with access to surface water; and
- The opportunity to allow for early rehabilitation of waste rock dumps concurrent with mining instead of post mining and backfilling.

In addition to the above, the proposed project allows for the access to future underground recourse which attracts potential economic benefits that would otherwise not be reaslised. Further to this, the aim of the proposed project to align closure objectives with that of the sustainable end state focus of the 2nd Draft Financial Provision Regulations.

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

8.1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

Environmental and socio-economic impacts associated with the proposed project were identified through site visits undertaken by SLR and specialists and through specialist studies. In addition to this, as part of the public participation process, I&APs and commenting authorities (see Section 7.2) are being provided with opportunities to provide input into the BAR process and comment on the proposed project, including the identification of environmental and socio-economic impacts.

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

A description of the assessment methodology used to assess the severity of identified impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated is provided in Section 7.6.

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

Table 8-1 provides a description of the impacts on environmental and socio-economic aspects in respect of each of the main project actions / activities and processes that will be assessed in Section 9.

TABLE 8-1: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO THE PROPOSED PROJECT

Potential impact	Activity	Project phases
Loss and sterilisation of mineral resources	• Partially open pit (result of in-pit dumping) • Raw (un-rehabilitated) waste rock dumps remaining on surface until mining ceases.	Closure
Safety to third party and animals	• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Decommissioning Closure
Loss of soil resources and land capability through contamination	• Decommissioning activities • Waste rock dumps remaining on surface	Decommissioning Closure
Loss of soil resources and land capability through physical disturbance	• Decommissioning activities • Waste rock dumps remaining on surface	Decommissioning Closure
Physical destruction of biodiversity	• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Decommissioning Closure
General disturbance of biodiversity	• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Decommissioning Closure

Potential impact	Activity	Project phases
Alternation of natural drainage pattern	• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Decommissioning Closure
Contamination of surface water resources	• Decommissioning activities • Partially open pit (access to pit lake) • Waste rock dumps remaining on surface	Decommissioning Closure
Lowering of groundwater levels	• Cessation of dewatering	Decommissioning
Contamination of groundwater resources	• Waste rock backfilled into the open pit as	Closure
Air pollution	• Short term decommissioning activities • Waste rock dumps remaining on surface	Decommissioning Closure
Increase in disturbing noise levels	• Post closure monitoring, aftercare and maintenance	Closure
Negative visual views	• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Decommissioning Closure
Road disturbance and traffic safety	Not applicable	Closure
Loss of heritage/cultural and palaeontological resources	Not applicable	Closure
Inward migration	Not applicable	Closure
Economic impact	• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Decommissioning Closure
Change in land use	• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Decommissioning Closure

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

The assessment of the significance of potential impacts, including the extent to which impacts can be avoided or mitigated, is included in Section 9 and Appendix E.

9 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

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

TABLE 9-1: ASSESSMENT OF SIGNIFICANT IMPACTS AND RISKS

H = High, M= Medium, L= Low, +

Reference to "+" in the table below, implies the impact is positive in nature

Activity	Potential impact	Aspects affected	Phase	Unmitigated impact rating					Management actions type	Mitigated impact rating					Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated	Cumulative and latent impact
				Severity	Duration	Spatial scale	Probability	Significance		Severity	Duration	Spatial scale	Probability	Significance		
• Partially open pit (result of in-pit dumping) • Raw (un-rehabilitated) waste rock dumps remaining on surface until mining ceases.	Loss and sterilisation of mineral resources	Geology (mineral resources)	Closure	L+	H	H	M	M+	• Manage through effective planning and execution of concurrent backfilling only (In-pit dumping)	H+	L	H	H	H+	• Can be reversed with mitigation • Will not cause irreplaceable loss of a resource. Even with poor planning and placement of rock into the pit access to the underground mining resource can be complicated which will not sterilise the resource but reduces the related efficiencies • Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Safety to third party and animals	Topography	Decommissioning Closure	H	H	M	M	H	• Manage through implementing approved EMPr • Removal of potential hazardous infrastructure (except waste rock dumps) • Remedy through rehabilitation of waste rock dumps • Control by making the open pit safe • Remedy through emergency response procedure	L	H	M	L	L	• Loss or injury to third parties or animals cannot be reversed • Irreplaceable loss in the event of loss of third party or animals • Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified
• Decommissioning activities • Waste rock dumps remaining on surface	Loss of soil resources and land capability through contamination	Soil and land capability	Decommissioning Closure	H	H	M	H	H	• Manage through implementing approved EMPr • Remedy through rehabilitation • Remedy through emergency response procedure	L	L	L	L	L	• Can be reversed with mitigation • Possible irreplaceable loss of a resource without mitigation • Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified

Activity	Potential impact	Aspects affected	Phase	Unmitigated impact rating					Management actions type	Mitigated impact rating					Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated	Cumulative and latent impact
				Severity	Duration	Spatial scale	Probability	Significance		Severity	Duration	Spatial scale	Probability	Significance		
• Decommissioning activities • Waste rock dumps remaining on surface	Loss of soil resources and land capability through physical disturbance		Decommissioning Closure	H	H	L	H	H	• Manage through implementing approved EMPr • Remedy through rehabilitation • Manage through design of permanent landforms • Management through post closure monitoring	L	M	L	L	L	• Can be reversed with mitigation • Possible irreplaceable loss of a resource without mitigation • Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Physical destruction of biodiversity	Biodiversity	Decommissioning Closure	H	H	M	H	H	• Manage through implementing approved EMPr • Management through establishment of sustainable aquatic and terrestrial habitats • Management through post closure monitoring	H+	H	M	M	H+	• Can be reversed and enhanced with safe access to pit lake • Possible irreplaceable loss of a resource without mitigation • Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	General disturbance of biodiversity		Decommissioning Closure	H	H	M	H	H	• Manage through implementing approved EMPr • Management through post closure monitoring	M+	M	M	M	M+	• Can be reversed and enhanced with access to pit lake • Possible irreplaceable loss of a resource without mitigation • Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Alternation of natural drainage pattern	Surface	Decommissioning Closure	M-L	H	M	L	M to L	• Remedy through removal of infrastructure (except waste rock dumps) • Remedy through rehabilitation of waste rock dumps	L	H (L for waste rock dumps)	M	L	L	• Cannot be reversed for the pit • Will cause irreplaceable loss of water to the catchment for that is collected in the pit. However, collection of run-off in the pit does contribute to the development of a pit lake which can be used for alternative uses • Can be	No cumulative impact or additional latent impacts have been identified

Activity	Potential impact	Aspects affected	Phase	Unmitigated impact rating					Management actions type	Mitigated impact rating					Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated	Cumulative and latent impact
				Severity	Duration	Spatial scale	Probability	Significance		Severity	Duration	Spatial scale	Probability	Significance		
															manged/mitigated to acceptable levels	
• Decommissioning activities • Partially open pit (access to pit lake) • Waste rock dumps remaining on surface	Contamination of surface water resources		Decommissioning Closure	H	H	M	H	H	• Manage through implementing approved EMPr • Remedy through implementation of the topography/topsoil and revegetation plans • Manage through post closure monitoring • Manage and remedy through installation of floating wetlands • Remedy through compensation in the event of loss to third parties • Remedy through emergency response procedures	L	L	L	L	L	• Can be reversed with mitigation • Possible in the unmitigated scenario as the pit lake will become a surface water resource that is contaminated • Can be manged/mitigated to acceptable levels	A potential latent impact could be associated with long terms deterioration of pit lake water quality subject to the success of the ongoing floating wetland treatment. If this latent impact manifests and cannot be mitigated through treatment adaptations then the use of/access to the pit lake will have to be reconsider4ed. The associated default management measures will be to fence and/or berm off access to the pit lake. No cumulative impacts have been identified
• Cessation of dewatering	Lowering of groundwater levels	Groundwater	Decommissioning	Insignificant					• Manage through post closure monitoring • Remedy through compensation in the event of loss to third parties	Insignificant					• Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified
• Waste rock backfilled into the open pit as part of in-pit dumping • Waste rock remaining on surface	Contamination of groundwater resources		Closure	L	H	L	L	L	• Manage through implementing approved EMPr • Management through post closure monitoring • Remedy through compensation in the event of loss to third parties	L	M	L	L	L	• Cannot be reversed • Unlikely to cause irreplaceable loss of a resource as predicted pollution plume does not extend to third party boreholes. Also the pit acts as a sink which minimises the extent of the pollution plume • Can be	No additional latent impacts have been identified. Modelling results includes contributions from off-site sources in the context of current water quality. The predicted modelled results therefore are cumulative in

Activity	Potential impact	Aspects affected	Phase	Unmitigated impact rating					Management actions type	Mitigated impact rating					Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated	Cumulative and latent impact
				Severity	Duration	Spatial scale	Probability	Significance		Severity	Duration	Spatial scale	Probability	Significance		
															manged/mitigated to acceptable levels	nature.
• Short term decommissioning activities • Waste rock dumps remaining on surface	Air pollution	Air	Decommissioning Closure	L	H	L	L	L	• Manage through implementing approved EMPr • Management through post closure monitoring	L	M	L	L	L	• Can be partially reversed • Unlikely to cause irreplaceable loss of a resource • Can be manged/mitigated to acceptable levels	No additional latent impacts have been identified. Modelling results includes contributions from off-site sources in the context of current air quality. The predicted modelled results therefore are cumulative in nature.
• Post closure monitoring, aftercare and maintenance	Increase in disturbing noise levels	Noise	Closure	L	L	L	L	L	• Management through maintenance of equipment and vehicles • Management through noise attenuation for trucks and vehicles • Manage through noise activities during the day time only	L	L	L	L	L	• Cannot be reversed • Possible to cause irreplaceable loss of a resource • Can be manged/mitigated to acceptable levels	No cumulative impact or additional latent impacts have been identified
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Negative visual views	Visual	Decommissioning Closure					H	• Manage through implementing approved EMPr • Remedy through rehabilitation • Management through post closure visual assessments					L	• Can be reversed with mitigation • Possible to cause irreplaceable loss of a resource • Can be manged/mitigated to acceptable levels	No latent impacts have been identified. Assessing impacts in the context of surrounding mines provides a cumulative impact assessment perspective.
Not applicable	Road disturbance and traffic safety	Traffic	Closure	Insignificant					• Manage through implementing approved EMPr • Remedy through emergency response procedures	Insignificant					• Can be reversed with mitigation • Possible to cause irreplaceable loss of a resource • Can be manged/mitigated to acceptable levels	Not applicable
Not applicable	Loss of heritage/cultural and palaeontological resources	Heritage/cultural and palaeontological resources	Closure	Insignificant					• Management through chance find procedures • Remedy through emergency response procedures	Insignificant					• In the unlikely event of a loss of these resources, the loss cannot be reversed • In the unlikely event of a loss of these	Not applicable

Activity	Potential impact	Aspects affected	Phase	Unmitigated impact rating					Management actions type	Mitigated impact rating					Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated	Cumulative and latent impact
				Severity	Duration	Spatial scale	Probability	Significance		Severity	Duration	Spatial scale	Probability	Significance		
															resources, this will cause irreplaceable loss • Can be manged through chance find procedures	
Not applicable	Inward migration	Socio-economic	Closure	Insignificant					• Manage through implementing approved EMPr	Insignificant					• Can be manged/mitigated to acceptable levels	Not applicable
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Economic impact		Decommissioning Closure	M+	H	M	H	H+	• Manage through implementing approved EMPr • Manage though effective planning and execution of concurrent backfilling only (In-pit dumping)	H+	H	M	H	H+	• Cannot be reversed with mitigation • Unlikely to cause irreplaceable loss as a change to the closure strategy allows for the access to future underground resources • Can be enhanced with management/mitigation measures	No latent impacts have been identified.
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Change in land use	Land use	Decommissioning Closure	H	H	M	H	H	• Manage through implementing approved EMPr • Remedy through rehabilitation	M+	H	M	M	H+	• Can be reversed with mitigation • Possible to cause irreplaceable loss of a resources • Can be managed/mitigated to acceptable levels	No latent impacts have been identified. Depending on the nature and scale of surrounding mining activities at the post closure stage, this could be cumulative impact category

10 SUMMARY OF SPECIALIST REPORT FINDINGS

A summary of the specialist findings are provided in the table below.

TABLE 10-1: SUMMARY OF SPECIALIST RECOMMENDATIONS

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
Air Quality	The main findings from the assessment of the closure options at Tshipi Borwa Manganese Mine are as follow: • The main sources of emissions during the proposed closure phase is windblown dust from the WRDs. The main pollutants of concern are PM2.5, PM10 and TSP. • Unmitigated windblown dust emissions from the four WRDs are 32.20 tpa for PM2.5, 359.22 tpa for PM10 and 1 039.33 tpa for TSP. By covering/ controlling 80% of the areas, the resulting reduction in emissions is 99%. • Unmitigated PM10 daily GLCs due to windblown dust from the WRDs are in compliance off-site, only exceeding the daily NAAQS of 75 µg/m³ on-site at the WRDs. Annual average concentrations comply on- and off-site. The impact significance is LOW. With mitigation in place (vegetation and revegetation) the impact significance reduces to VERY LOW. • Unmitigated PM2.5 daily GLCs due to windblown dust from the WRDs are low and well within compliance off-site with the only on-site exceedances at West_WRD. Annual average concentrations comply on- and off-site. The impact significance is LOW. With mitigation in place (vegetation and revegetation) the impact significance reduces to VERY LOW. • Unmitigated maximum daily dustfall rates are below the NDCR residential limit (600 mg/m²/day) off-site, and below the non-residential limit of 1 200 mg/m²/day on-site. The impact significance is LOW. With mitigation in place (vegetation and revegetation) the impact significance reduces to VERY LOW. • The highest annual average manganese GLC due to unmitigated windblown dust from the WRDs is 0.03 µg/m³, falling well below the WHO annual average manganese guideline of 0.15 µg/m³. The	X	• Section 7.4.1.8 (baseline) • Section 9 (summary of impact finding and management actions) • Section 26 (management actions) • Section 28 (monitoring) • Appendix E (detailed impact assessment) • Appendix I (specialist study)

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	impact significance is VERY LOW. • At the time of closure, all operations at Tshipi Mine would have ceased, with farming activities and vehicles travelling on the paved and unpaved roads the only remaining contributors to PM concentrations and dustfall. The air quality around Tshipi Mine is likely to improve significantly by closure phase. For the waste rock dumps the same mitigation scenarios can be applied: • Operational (up to 2048): 90% CE on the "baseline" exposed areas, to reflect revegetation (medium term). • Long-term Scenario (closure and post-closure): 100% CE on all exposed surfaces (assumption being that all are fully vegetated). • Continue with the current dustfall monitoring network throughout the closure phase. • Should aggregate crushing be implemented, ensure placement of the crusher as far away from the sensitive receptors as possible.		
Noise	The findings of the noise assessment are: • Noise is currently generated by the open pit surface mining and processing activities. • The main Noise Sensitive receptors (NSRs) are farmsteads located to the northwest, west and south of Tshipi Mine. • Based on the prevailing wind field (2015-2017), noise impacts are expected to be more notable to the east and south during the day and to the north and north-northwest during the night. • Ambient baseline noise levels were below the IFC guideline for residential areas (55dBA) at all five sampling locations, and no audible noise from the mining operations were noted in the filed log sheets, only noise from cicadas. • The preferred closure option is likely to result in lower noise impacts due to fewer activities and the use of less equipment. The significance of the impacts expected during the preferred closure option, with mitigation in place, is VERY LOW. • The potential for noise impacts from the other closure options considered would have similar noise	X	• Section 7.4.1.9 (baseline) • Section 9 (summary of impact finding and management actions) • Section 26 (management actions) • Section 28 (monitoring) • Appendix E (detailed impact assessment) • Appendix J (specialist study)

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	impacts, with slight changes due to locations and operational intensity. All closure options would result in lower noise levels than the operational phase. In conclusion, ambient baseline sound pressure levels were below the IFC guideline for residential areas which included influencing from the natural environment. The preferred closure option is likely to result in lower noise impacts due to fewer activities and the use of less equipment, resulting in overall lower noise levels. The significance of the impacts expected during the preferred closure option, with mitigation in place, is VERY LOW. For general activities, and activities during the closure phase, the following good engineering practice should be applied: • All diesel-powered equipment and plant vehicles should be kept at a high level of maintenance. This should particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance. • Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels. • In managing noise specifically related to truck and vehicle traffic, efforts should be directed at: o Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program. o Maintain road surface regularly to avoid corrugations, potholes etc. o Avoid unnecessary idling times. o Minimising the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. Alternatives to the traditional reverse 'beeper' alarm such as a 'self-adjusting' or 'smart' alarm could be considered. These alarms include a mechanism to detect the local noise level and automatically adjust the output of the alarm is so that it is 5 to 10 dB above the noise level near the moving equipment. The promotional material for some smart alarms does state that the ability to adjust the level of		

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	the alarm is of advantage to those sites 'with low ambient noise level' (Burgess & McCarty, 2009). o Limiting traffic to hours to between 06:00 and 18:00. • Where possible, other non-routine noisy activities likely to occur during decommissioning and closure, should be limited. • Should aggregate crushing be implemented during post-closure, this should be located as far as possible from sensitive receptors. • A noise complaints register must be kept. • In addition, short term ambient noise measurements could be conducted during the closure phase at the five sampling locations to confirm noise levels remain similar or lower to surveyed baseline levels.		
Visual	• Earthworks to shape the WRDs should be executed in such a way that only the footprint and a small 'construction buffer zone' around the proposed WRDs is exposed. In all other areas, the natural occurring vegetation, should be retained, especially along the periphery of the site. Dust suppression techniques should be in place always during all phases of the project, where required. • In terms of waste rock dumps and in-pit dumping the following apply: o Final shaping and dumping should be engineered such that the sides of the dumps are articulated in a fashion that create areas of light and shadow interplay. o Harsh, steep engineered slopes (maximum slope 1:3) should be avoided as these could impose an additional impact on the landscape by contrasting dramatically with the existing rolling topography. The waste rock dumps, are the most visible surface features that will remain at closure and it is important that a long-term view of their integration with the surrounding landscape be taken; o The progressively reclaimed landscape can be no more stable than the adjacent undisturbed landscape; therefore, it can be assumed that the reclaimed areas will be less stable and must be designed accordingly, with gentler slopes, and drainage systems that do not concentrate run-off; o Maintain the final landform height and slope angles for stockpiles as low as possible and not to	X	• Section 9 (summary of impact finding and management actions) • Section 26 (management actions) • Appendix E (detailed impact assessment) • Appendix K (specialist study)

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	be higher that existing rehabilitated dumps in the vicinity of the mine. o Grass and tree seeding of the dumps should be undertaken to emulate the groupings of natural vegetation in adjacent areas and mimic where possible the within the Eastern Kalahari Savanna Bioregion (Mucina and Rutherford 2006). o Topsoil stripped prior to development will be used to provide the growth medium. o Dust control by vegetation cover. o Where new vegetation is proposed to be introduced to the site and onto the WRDs, an ecological approach to rehabilitation, as opposed to a horticultural approach should be adopted. For example, communities of indigenous plants enhance biodiversity, a desirable outcome for the project rehabilitation. This approach can significantly reduce long term costs as less maintenance would be required over conventional methods one the vegetation is established. • All maintenance roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface		
Soils and land capability	• The management of Tshipi Borwa mine should commit a suitable volume of water available at the final pit void to the aquaculture project if this is considered as a future potential land use. • A suitably qualified and experienced consultant must be appointed for the detailed planning of the construction and operation of the aquaponics unit if this is considered as a future potential land use. • In conjunction to the planning of the aquaponics units, the construction and operation of solar PV facility or facilities must be considered in order to provide a sustainable source of energy to the aquaponics units if this is considered as a future potential land use. • The beneficiaries of the aquaponics unit (or possible investors) should be contacted at least two years prior to the implementation of the project to ensure that they undergo proper training and capacitation to successfully construct and operate the aquaponics units if this is considered as a future potential land use.	X	This BAR outlines additional concepts that could be considered as potential future additional land uses, which could be considered at some point in the future. This is outlined in Section 3.2.9.

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	• The aquaponics project must be marketed in advance in order to create market interest for the produce to be produced at the Tshipi Borwa mine if this is considered as a future potential land use. • The aquaponics units must be designed with ergonomic principles in mind to ensure that both human and natural resources are conserved as far as possible if this is considered as a future potential land use.		
Biodiversity	• To ensure a sustainable system which supplies as enriching an experience as possible to its users as well as contributing to the biodiversity support and ecology of the area, suitable habitats should be created within the pit-lake, not only for the fish species to be introduced but for other species, such as water-birds, aquatic macro-invertebrates and potentially amphibians. This can be achieved through the implementation of the pit lake design principles as set out in Section 3.2.6, which focus on: o The pit lake level; o the creation of shallows; o The creation of gravel beds and scree slopes; o introduction of aquatic vegetation; o Construction of floating wetlands; and o Introduction of desirable fish species. • In order for the pit lake to function effectively as part of the greater terrestrial ecosystem it is imperative that the terrestrial areas adjacent to the lake are sloped and profiled so as to create flat and gently sloping areas which can be suitably revegetated in line with the surrounding Kathu Thornveld habitat. This will ensure that sufficient terrestrial habitat is located adjacent to the pit lake, supporting faunal species through habitat and food resource provision. This will ensure that an interconnected ecosystem between freshwater and terrestrial is developed and maintained. This can be achieved through the topography and topsoil plan and the revegetation plan (Sections 3.2.7.1 and 3.2.7.2 respectively. The topography and topsoil plan focusses on: o Topsoil ripping, use and depth; o The side slopes of the waste rock dump in terms of sloping and netting; and	X	• Section 3.2.6 and 3.2.7 (creation of aquatic and terrestrial habitats) • Section 9 (summary of impact finding and management actions) • Section 26 (management actions) • Section 28 (monitoring) • Appendix E (detailed impact assessment) • Appendix G (specialist study)

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	o Accessibility to the pit lake. • The revegetation plan focusses on: o Planting of trees and shrubs; o Collective seeding; o Seed mixes; o Reseeding time; o Habitat surrounding the pit lake; and o Control of alien and invasive species. • Physical relocation of faunal species as part of the proposed project is not a viable option given that it is costly and requires areas to be fenced off in order to control species movement. Natural relocation and faunal dispersal will be relied upon in order to repopulate the rehabilitated areas, provided the habitat is suitable. In order to create an environment that will support the natural relocation of faunal species the following should be noted: o The quality of the pit lake water needs to be suitable for animal consumption in the long term. This may be achieved through the establishment of floating wetlands; o The quality of the pit lake water needs to be suitable to support instream aquatic species in order to ensure that the pit lake functions as a complete ecosystem; o Accessibility to and through the site must not be hindered. This forms part of the revegetation/landscape plan discussed above; and o The establishment of alien invasive species must be avoided as this will create undesirable habitats. • A suitable habitat will provide a food resource to attract faunal species, which can be supported by the pit lake as a source of water in a water scare environment. The installation of floating wetlands and the creation of reed beds along the edge of the pit provide a suitable habitat for breeding and foraging for avifaunal species and amphibians. The natural introduction of insects provides a food resource to other faunal species but also is a good indicator of the overall health of the ecosystem through species diversity and abundance. The natural introduction of arachnids provides a good		

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	indicator of the overall success to the pit lake activities through the rate of recolonization. • Monitoring is essential in order to scientifically prove that a self-sustainable aquatic ecosystem has developed or show a positive trend towards successful rehabilitation. This will prove that environmental degradation and biological diversity have been mitigated and restored where it has been negatively impacted upon. The important aspect to keep in mind is that it is not only a visual inspection, but measurable information gathering e.g. water quality (both ground and surface), aquatic vegetation, eutrophic levels and aquatic macro-invertebrate diversity etc. The monitoring data must be of such a standard that meaningful conclusions can be made and a trend indicated. Good record keeping is essential in order to provide long term analysis of the collected data as well as ecological trends. This requires the implementation of a freshwater and floral monitoring programme. In this regard: o The freshwater monitoring plan focuses on surface water quality, toxicity testing, eutrophication testing and habitat and aquatic macro-invertebrate assessments. o The floral monitoring plan focuses on: o Measurements of the crown and basal cover; o Species diversity; o Species abundance; o Recruitment of indigenous species; o Alien vs Indigenous plant ratio; o Recruitment of alien and invasive plant species; o Effectiveness of alien and invasive plant control measures; o Erosion levels and the efficacy of erosion control measures; and o Vegetation community structure including species composition and diversity which should be compared to the previous round of monitoring.		
Pit lake	• Climate is the single most important factor on the hydrologic processes associated with Tshipi pit lake formation. In general, surface hydrologic processes (e.g. direct precipitation, evaporation, surface water runoff) are defined by regional climate. Groundwater inflows are generated from precipitation recharge and tend to buffer short-term climatic changes, but long-term climatic	X	• Section 3.2.5 (pit lake development) • Section 9 (summary of impact finding and management

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	changes will be reflected in groundwater inflows over the long-term. The impacts of a changing climate are largely unknown but have been somewhat incorporated in the climate model as changing patterns of rainfall. • Mine closure is increasingly recognised as a whole-landscape development exercise which must consider all closure landform elements and how they will interact over time. The water quality options presented herein present strong arguments that completely backfilled & partial backfilled pit may not be the best solution to risks presented by pit lakes at mine closure when considering "short term" benefits in a water scarce area. The water quality of the hydraulic sink lake options is expected to deteriorate over time through evaporation and the consequent entrapment of solutes. Although not desirable in itself, this water quality deterioration indicates that the pit lake is functioning as it should as an evaporative 'terminal' sink and would better protect the surrounding groundwater environment from potentially contaminated waters resulting from the surrounding waste rock dumps and other mine facilities that may cause pollution to groundwater. • There are two scenarios modelled which will generate pit lakes, namely Option 3 and 4. Hydraulic and geochemical modelling has indicated that of the two options which generate pit lakes, the pit lake water for Option 3 (Concurrent or In-pit Dumping) produces more favourable water quality concentrations for livestock suitability, than all other options in the short term. • The final pit lake elevation at Tshipi Borwa Mine is projected to reach quasi-equilibrium level at varying heights depending on the backfilling options. The projected pit lake quasi-equilibrium elevation represents long-term equilibrium conditions and has considered occurrences of drought and floods in the future using WGEN and probabilistic climate modelling. Expectations are that it will take an extremely long time before the pit lake water levels rise to near their final equilibrium elevations for the non-backfilled options. Because the pit lake will be a sink for groundwater it is not expected to impact on regional groundwater quality which is an important long term sustainable consideration. • A benefit/liability comparative assessment for short- and long-term water use is provided below.		actions) • Section 26 (management actions) • Section 28 (monitoring) • Appendix E (detailed impact assessment) • Appendix H (specialist study)

<table>
<tr><th>Specialist study</th><th>Recommendation of specialist</th><th>Specialist recommendations that have been included in the EIR (mark with an x)</th><th>Reference to applicable section in this report</th></tr>
<tr><td></td><td>
<table>
<tr><th>Backfilling closure option</th><th>Short term benefits/liabilities</th><th>Long term benefits/liabilities</th></tr>
<tr><td>Option 1
Complete backfill</td><td>Water use benefit for only 25 years before treatment

Water extraction requires wells, pumps etc Wells/screens likely to clog up with Iron</td><td>Requires less treatment for long term use

Flow through pit means contamination plumes released to wider groundwater system</td></tr>
<tr><td>Option 2
Fill To Regional Groundwater level</td><td>Water use benefit for only 25 years before treatment

Water extraction requires wells, pumps etc. Wells/screens likely to clog up with Iron</td><td>Requires less treatment for long term use

Flow through pit means contamination plumes released to wider groundwater system</td></tr>
<tr><td>Option 3
Concurrent backfill</td><td>Water use benefit for 200 years before treatment

Water extraction requires much less infrastructure than option 1 & 2</td><td>Requires more treatment for long term use, but this can potentially include passive treatment

Hydraulic sink benefit as cone of depression captures wider pollution plumes from other mine areas and sources (WRDs etc)</td></tr>
<tr><td>Option 4
No Backfill</td><td>Water use benefit for 50 years before treatment

Water extraction requires much less infrastructure than option 1 & 2</td><td>Requires most treatment for long term use.

Hydraulic sink benefit as cone of depression captures wider pollution plumes from other mine areas and sources (WRDs etc)</td></tr>
</table>
</td><td></td><td></td></tr>
</table>

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	• From the assessment contained in the table above, it is apparent that the beneficial use of the pit lake for water supply purposes will be limited to short term use (<100 years) before water treatment is likely to be required. In the short term, concurrent backfill offers the best water quality solution. Complete backfill of the pit may result in enhanced permeability which may enhance storage of water but water qualities are not necessarily automatically useable and that solution would also need a means of extraction (bores, screens, pumps etc). Preserving a hydraulic sink (Option 3 and 4) may also in fact be a more sustainable long term solution as water (and any pollutants contained within) will be drawn towards the pit and effectively containing them as the cone of depression has its centre at the pit. • The modelling option (3 and 4) that includes the development of a pit lake has indicated that there may be elevated concentrations of nitrogen compounds in the upper layer of the lake over time. A future safeguard regarding the nitrogen concentrations could be to put in place a passive treatment solution to reduce nitrogen compounds in the pit water. The feasibility of using a passive treatment solution is examined such that it can lead to a potential treatment option, if required. The use of floating wetlands is proposed for the passive treatment of water quality within the pit lake for the following reasons: o A floating system is relatively easy to implement and the floating wetland area can be increased if required due to changes in water chemistry; o An area of 2.4ha is required in order to install the floating wetlands as this area provides sufficient depth and coverage for the system to function. Modelled results indicated that it will take 10 years before the floating wetlands can be installed; o Floating wetland has a positive influence on the chemistry of the pit lake water for other water quality parameters (likely reduction of other key water quality parameters). • The predicted modelling results of water quality of the pit lake with the installation of floating wetlands indicate that with the installation of floating wetlands the water quality is acceptable for livestock watering and the creation of an aquatic habitat for a minimum of 200 years (the modelled		

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	period). It is possible for similar water quality to be achieved beyond the modelled period of 200 years and field trials supplemented with additional modelling are recommended for ongoing design refinement.		
Heritage and palaeontological exemption letter	PGS Heritage and its specialist have conducted numerous HIA and PIA studies for the Tshipi Ntle Mine and surrounds. Listed below an extract of some of the studies conducted. • 2009 - Heritage Impact Assessment: Ntsimbintle Mining (Pty) Ltd on Portions 1, 2, 3 and 8 of the Farm Mamatwan 331 and the Farm Moab 700 in the Kgalagadi District Municipality of the Northern Cape Province • 2017 – Heritage Opinion - Heritage Impact Assessment for the Environmental Impact Assessment and Environmental Management Programme Amendment Report for the Tshipi Borwa Mine • 2018 - Proposed Waste Rock Dump Project at Tshipi Borwa Mine, Near Hotazel, Northern Cape Province. Phase 1 – Heritage Impact Assessment. • 2019 - Palaeontological Desktop Assessment for the Proposed Waste Rock Dump Project at Tshipi Borwa Mine, Near Hotazel, Sahra CaseID: 12573 • 2019 - Request for exemption from a Heritage Impact Study: Mamatwan Mine Waste Rock Dump Extension, Hotazel, Joe Morolong Local Municipality, Northern Cape Province. • 2019 - An 18m Wide (On Surface) Boundary Is Located Between The Mamatwan Mine And The Tshipi Borwa Mine. Tshipi and Mamatwan Mine Have Approval to Mine the 18m Wide Boundary Pillar. Additional Capacity Is Required to Store Waste Rock Generated as part of Mining the Boundary Pillar. To cater for The Additional Storage, it is proposed that the Mamatwan Sinterfontein and the Tshipi eastern waste rock dumps are merged to fill the void between the two dumps. MMT is proposing on amending their approved EMP to cater for the merging of the waste rock dumps- Case Id: 13652 Our studies have concluded that no heritage resources were present in the development of the Tshipi mine and the current expansion into the highly disturbed mine infrastructure as well as the proposed	X	• Section 7.4.1.11 (baseline) • Section 9 (summary of impact finding and management actions) • Section 26 (management actions) • Appendix E (detailed impact assessment) • Appendix N (specialist study)

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	changes to the rehabilitation activities as listed in the EMPr will not have impact heritage resources. Our palaeontological desktop assessments did however identify the possibility of stromatolites present in the mining area. However, it was rated as having a very low possibility and mining activities will have a low probability of impacting on the palaeontological resources of the area. Conclusions and Recommendations: • With regard to the proposed process, the following recommendations are made: • The findings of the HIAs concluded confirmed that no impacts on heritage resources are foreseen. Our observation and considered opinion on this remains. • The palaeontological studies conducted observed that, but it is considered that existing activities at the Tshipi Borwa Mine, near Hotazel, Northern Cape is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. It is thus our opinion and recommendation and opinion that the proposed amendments to the EMPr should be exempted from any further heritage or palaeontological studies.		
Economic	The economic gain from the approved closure scenario to backfill the open pit will be approximately R1.3billion over 20 years – which will be a nett cost to Tshipi that will be funded through a provision in operating costs i.e. a reduction in profitability and taxation. If the backfilling of the pit proceeds it will however result in a potential loss of R22.7 billion to the national, regional and local economies due to underground resources not being mined. Limiting the open pit rehabilitation to in-pit dumping or partial back-filling will create an economically efficient opportunity to access underground mineral resources. Adopting an alternative closure strategy of not completely or partially backfilling the pit will allow for access to underground resources with a potential economic gain to the national, regional and local economies. The potential economic losses from not undertaking backfilling activities will be far outweighed by underground mining activities.	X	• Section 9 (summary of impact finding and management actions) • Section 26 (management actions) • Appendix E (detailed impact assessment) • Appendix L (specialist study)

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	Based on the evaluation of available economic indicators, it is Mercury's suggestion conclusion to implement the alternative closure scenario, which will only allow for concurrent backfill i.e. in-pit dumping during the operational phase and no post mining back-filling. The proposed closure scenario presents an opportunity for an additional underground mining operation with a potential life of mine will significantly contribute towards the local, regional and national economies through the following: • Increased foreign investment and income; • Direct impacts arising from wages, taxes and profits. This includes money spent to pay for salaries, supplies, raw materials, and operating expenses; • Indirect impacts from the initial and operational spending which will create additional activity within the local and regional economy, and • Induced impacts as a result of increased personal income or spending power. Implementing management measures and commitments as outlined in the EMPr will ensure that the project is executed within the framework of sustainable development, which will ensure that potential negative impacts are minimised mitigated and positive impacts enhanced.		
Financial provision	• The preliminary closure plan objectives and principles include the following: o To create a functioning ecosystem that supports a sustainable end land use; o To ensure a suitable pit lake quality for livestock watering and biodiversity; o Environmental damage is minimised to the extent that it is acceptable to all parties involved; o Mine closure is achieved efficiently, cost effectively and in compliance with the law; and o The social impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised. • The closure target outcomes for the site are therefore assumed to be as follows: o To achieve chemical, physical and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure; o To protect surrounding surface water, groundwater, soils and other natural resources from loss	X	• Sections 18 and 27 (financial provision) • Appendix M (specialist study)

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	of current utility value or environmental functioning; o To limit the rate of emissions to the atmosphere of particulate matter to the extent that degradation of the surrounding areas' land capability or environmental functioning does not occur; o To maximise visual 'harmony' with the surrounding landscape; and o To create a final land use that has economic, environmental and social benefits for future generations that outweigh the long term aftercare costs associated with the mine. • The objective of annual rehabilitation planning is to: o Review concurrent rehabilitation and remediation activities already implemented. o 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 final rehabilitation, decommissioning and mine closure plan. o Establish a plan, schedule and budget for rehabilitation for the forthcoming 12 months. o Identify and address shortcomings experienced in the preceding 12 months of rehabilitation. o 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 instruments. • Annual rehabilitation and remediation activities associated with the annual rehabilitation plan will focus primarily on: o Clearing of vegetation in accordance with the relevant vegetation management procedures. o Destructing and disturbing as little vegetation and biodiversity as possible (i.e. limiting the footprint of the mines operation), and retaining as much natural vegetation as possible. o Stripping and stockpiling of soil resources in areas designated for development in line with a soil conservation procedure. o Backfilling of mined out pit areas (i.e. in-pit dumping during operations) in accordance with the mine plan. o Rehabilitation of overburden dumps (no longer required) that are expected to remain post		

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	closure. o General, hazardous and medical waste collection, storage and disposal. o Ongoing monitoring of groundwater, surface water and air quality. The closure cost liability calculations have been determined for the following periods (as per the 2nd Draft Financial Provision Regulations (Government Gazette 42464, 2019)), namely: • Current closure cost liability (as at June 2019), R 186,488,203 (excl. VAT). • The closure cost liability incurred over the next 12 months (i.e. from June 2019 to June 2020), • R 15,505,059 (excl. VAT). • LOM closure cost liability, 25 years from now (as at June 2044), R 316,318,824 (excl. VAT). The total estimated cost of the post-closure monitoring and inspection activities, has been calculated to be: • R 17,382,250 (excl. VAT) for the current pit void and mine layout. • R 20,006,250 (excl. VAT) for the LOM pit void and mine layout. In accordance with the 2nd Draft Financial Provision Regulations, the amount to be set aside for the current closure and rehabilitation of the Tshipi Borwa Mine (current value (CV) as at June 2019), is calculated to be R 268,680,158 (incl. VAT). For comparative purposes, the amount to be set aside for the current closure and rehabilitation of the Tshipi Borwa Mine (current value (CV) as at June 2019), in accordance with the current 2015 Financial Provisioning Regulations is calculated to be R 361 815 209.00 (incl. VAT).		

11 ENVIRONMENTAL IMPACT STATEMENT

11.1 SUMMARY OF KEY FINDINGS

This section provides a summary of the findings of identified and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios. A summary of the potential impacts (as per Section 9), associated with the preferred alternative (as per Section 7.1), in the unmitigated and mitigated scenarios for project phases is included in Table 11-1 below.

The assessment of the proposed project presents the potential for significant impacts to occur (in the unmitigated scenario in particular) on the biophysical, cultural and socio-economic environments both on the project site and in the surrounding area. A summary of the positive and negative impacts comparing the impact significance rating in both the unmitigated and mitigated scenarios for the approved commitment (option 1) versus the preferred closure option (option 3) is included in Table 11-1 below. In this regard, the proposed project in some instances reduces the significance impact rating in the mitigated scenario (eg. Air quality), and in other instances changes the mitigated significance impact rating to a positive (eg. geology, biodiversity, economic impact and land use impacts) when compared to the approved EMPr. Latent impacts are also identified in the table below. The detailed impact assessment discussion is included in Appendix E.

Provided the EMPr is effectively implemented there is no biophysical, social or economic reason why the project should not proceed.

TABLE 11-1: SUMMARY OF POTENTIAL IMPACTS

Aspect	Potential impact	Impact significant (approved EMPr)		Impact significance (proposed project)		Latent impact
		Unmitigated	Mitigated	Unmitigated	Mitigated	
Geology (mineral resources)	Loss and sterilisation of mineral resources	High	Low	Medium and positive	High and positive	No latent impact
Topography	Safety to third party and animals	High	Low	High	Low	No latent impact
Soil and land capability	Loss of soil resources and land capability through contamination	High	Low	High	Low	No latent impact
	Loss of soil resources and land capability through physical disturbance	High	Low	High	Low	No latent impact
Biodiversity	Physical destruction of biodiversity	High	Medium	High	High and positive	No latent impact
	General disturbance of biodiversity	High	Medium	High	Medium and positive	No latent impact
Surface	Alternation of natural drainage patter	Medium	Low	Medium to Low	Low	No latent impact

Aspect	Potential impact	Impact significant (approved EMPr)		Impact significance (proposed project)		Latent impact
		Unmitigated	Mitigated	Unmitigated	Mitigated	
	Contamination of surface water resources	Medium	Low	High	Low	Potential latent impact
Groundwater	Lowering of groundwater levels	Insignificant				Not applicable
	Contamination of groundwater resources	Low	Low	Low	Low	No latent impact
Air	Air pollution	High	Medium (remained High for Mn concentrations)	Low	Low	No latent impact
Noise	Increase in disturbing noise levels	Not applicable	Not applicable	Low	Low	No latent impact
Visual	Negative visual views	High	Low	High	Low	No latent impact
Traffic	Road disturbance and traffic safety	Insignificant				Not applicable
Heritage/cultural and palaeontological resources	Loss of heritage/cultural and palaeontological resources	Insignificant				Not applicable
Socio-economic	Inward migration	Insignificant				Not applicable
	Economic impact	Medium to high and positive	Medium to high and positive	High+	High and positive	No latent impact
Land use	Change in land use	High	Low	High	High and positive	No latent impact

* Grey shaded cells are negative impacts. Blue shaded cells are positive impacts.

11.2 FINAL SITE MAP

The final preferred site layout plan is included in Figure 4. See also Appendix O for a composite map superimposed on the environmentally sensitive areas of the preferred site.

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

The detailed discussion around the positive and negative **unmitigated impacts** and risks of the proposed project and alternatives is provided in Section 7.5. A summary of the key positive and negative impacts in the mitigated scenario is tabulated below. A summary of the positive and negative impacts comparing the impact significance rating in both the unmitigated and mitigated scenarios for the approved commitment (option 1) versus the preferred closure option (option 3) is tabulated in Section 11.1 above.

TABLE 11-2: SUMMARY OF THE POSITIVE AND NEGATIVE IMPACTS AND RISKS

Potential impact	Significance (unmitigated)			
	Complete backfill	Partial backfill	Concurrent (in-pit dumping)	No backfill
Loss and sterilisation of mineral resources	High	High	Medium and positive	High and positive
Hazardous excavations and infrastructure (Safety to third parties and animals)	High	High	High	High
Loss of soil and land capability through contamination and physical disturbance	High	High	High	High
Physical destruction of biodiversity	High	High	High	High
General disturbance of biodiversity	High	High	High	High
Alteration of natural drainage patterns	Medium	Medium to Low	Medium to low	Medium to low
Contamination of surface water resources	Medium	Medium	High	High
Lowering of groundwater levels	Not applicable			
Contamination of groundwater resources	Low	Low	Low	Low
Air pollution	Low	Low	Low	Low
Disturbing noise levels	Not applicable	Low	Low	Low
Negative visual views	High	High	High	High
Road disturbance and traffic safety	Insignificant			
Loss of heritage/cultural and palaeontological resources	Insignificant			
Inward migration	Insignificant			
Economic impact	High	High	High and positive	High and positive
Change in land use	High	High	High	High

* Grey shaded cells are positive impacts.

12 IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES FOR INCLUSION IN THE EMPR

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

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

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

TABLE 12-1: ENVIRONMENTAL OBJECTIVES AND OUTCOMES

Aspect	Environmental objective	Outcome
Geology	To prevent unacceptable mineral sterilisation.	Minimise the sterilisation of economic minerals as far as possible.
Topography	To minimise changes to natural topography.	Limit the alteration of the topography during mining and through rehabilitation.
Soil and land capability	To minimise the loss of soil resources and related land capability through physical disturbance, erosion, compaction and soil pollution.	Handle, manage and conserve soil resources to be used as part of rehabilitation in order to support post closure land capability.
Biodiversity	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical and general disturbance.	Limit the area of disturbance as far as practically possible and create and enhance aquatic and terrestrial habitats
Surface water	To prevent unacceptable alteration of drainage patterns.	Ensure that the reduction of the volume of runoff into the downstream catchment is limited to what is only necessary and that natural drainage patterns are re-established as part of rehabilitation where possible in order to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.
	To prevent surface water contamination	Water quality within the pit lake remains acceptable for livestock watering purposes
Groundwater	To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users.	To ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that groundwater continues to be available to current users.
Air	To prevent air pollution health impacts	Ensure that any pollutants emitted as a result of the project remains within acceptable limits so as to prevent health related impacts
Noise	To prevent public exposure to disturbing noise	Ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties
Visual	To limit negative visual impacts	Limit negative visual views

Aspect	Environmental objective	Outcome
Heritage and cultural	To minimise the disturbance of heritage and palaeontological resources	Protect heritage and palaeontological resources where possible. In the event of a chance find, consult with a specialist and the SAHRA and in line with regulatory requirements
Socio-economic	To limit inward migration and related social impacts and enhance positive economic impacts	Work with existing structures and organisations to establish and maintain a good working relationship with surrounding communities, local authorities and landowners in order to limit the impacts associated with inward migration. Enhance the positive economic impacts by accessing future underground resources
Land uses	To prevent unacceptable negative impacts on surrounding land uses	Minimise the impact on land uses as little as possible in order to prevent unacceptable impacts on surrounding land uses and their economic activity

12.1.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

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

- Surface water quality within the pit lake;
- Groundwater quality;
- Aquatic bio-monitoring;
- Terrestrial monitoring; and
- Air quality.

Environmental impacts requiring monitoring are discussed further in Section 28.

12.1.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Appendix E and include:

- Decommissioning activities;
- Partially open pit (result of in-pit dumping);
- Cessation of dewatering activities;
- Access to pit lake;
- Waste rock remaining on surface; and
- Maintenance, monitoring and aftercare.

12.1.3 MANAGEMENT ACTIONS

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

12.1.4 ROLES AND RESPONSIBILITIES

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

- Ensuring that monitoring programmes are scoped to be appropriate and included in the annual mine budget;
- Identifying and appointing appropriately qualified specialists/engineers to undertake the monitoring programmes;
- Appointing specialists in a timeous manner to ensure work can be carried out to acceptable standards;
- Establishing and maintaining good working relations with surrounding communities and landowners; and
- Facilitating stakeholder communication, information sharing and a grievance mechanism.

13 ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION

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

14 ASSUMPTIONS, UNCERTAINTIES, LIMITATIONS AND GAPS IN KNOWLEDGE

14.1 ENVIRONMENTAL ASSESSMENT LIMIT

The BAR focuses on third parties only and does not assess health and safety impacts on employees and contractors because the assumption is made that these aspects are separately regulated by health and safety legislation, policies and standards, and that Tshipi will adhere to these, as they have done to date.

14.2 PREDICTIVE MODELS IN GENERAL

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

14.3 GEOCHEMISTRY

As part of the geochemical assessment work undertaken in support of the approved EMPr (SLR, August 2017), SPLP tests were undertaken using distilled water to represent neutral drainage conditions. Although the SPLP can determine the leachability of determinants, the liquid-to-solid ratio does not represent actual field conditions; therefore resultant concentrations should not be considered representative of run-off that could emanate from site. The tests are commonly used as a preliminary screening process to identify potential chemicals of concern (CoCs) based on a comparison against relevant water quality and effluent standards.

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

- The water chemistries used in the modelling are representative of input sources. It is not possible to model water quality without this essential assumption. Input water qualities are derived from the results of the geochemical characterisation programme. Therefore, the water compositions used in the modelling do not represent actual water samples but "theoretical" compositions;
- Predicting field-scale leaching from lab-scale leach tests is an approximation. Metal leaching at the field scale is variable through time and controlled by factors not fully applied at the lab scale. These factors include temperature, nature of the leaching solution, the solution to solid ratio, solution-solid contact time, particle size of the solid; and
- Modelled waters are in full thermodynamic equilibrium. Equilibrium is the computational basis of PHREEQC. Equilibrium is unlikely to be the case for all chemical components throughout all mine waters. However, geochemical research has shown that assuming equilibrium conditions may usefully describe the composition of natural and mine waters. The PHREEQC model simulates chemical reactions and contains the appropriate thermodynamic constants.

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

14.4 PIT LAKE

The following assumptions were made as part of the pit lake study (SLR, June 2019):

- Groundwater is currently not entering the open pit. It is assumed that the mining at Mamatwan has dewatered the area and that once mining and dewatering ceases at both pits, groundwater levels will begin to rebound as predicted by groundwater modelling;
- The high nitrate in the pit water samples and nearfield bores is due to ANFO i.e. residual chemicals from explosives and won't be an issue for long term closure;
- An open water evaporation factor of 0.8 has been applied to the pan evaporation data.
- Historical rainfall data has been used to develop a stochastic WGEN climate model;
- As Option 3 and 4 has been determined to be hydraulic sinks, evapo-concentration will continue forever. This means that the water within the pit could at some point in the future become unfit for human or animal consumption without intervention. The related impact assessment assumes that the floating wetland system for treating the pit lake water will be effectively implemented resulting in the appropriate water quality for at least 200 years. A related limitation is field data confirming the practical aspects of implementing this treatment system both within the first 200 years and beyond;
- Water held within the pore spaces in the waste rock dump mass is assumed to be instantaneously mixed with the pit lake water;
- It is assumed that there is an infinite supply of leachable constituents from the waste material and host geology;
- The information and results contained within the report are subject to the availability and integrity of the data sources. The potential impacts of the neighbouring Mamatwan mine was considered from a groundwater inflow and quality perspective. No other neighbouring mine(s) influence has been considered; and
- The GoldSim and PHREEQC modelling results contained in this report are predictive forecasts of likely future behaviour only;

14.5 BIODIVERSITY STUDY

The following points serve to indicate the assumptions and limitations of the aquatic study (SAS, May 2019):

- **Availability of analogous reference site:** Only two analogous sites were assessed as part of the aquatic study. It is important to note that the assessments were made on impoundments and not end pit lakes and as such some inaccuracies in comparisons to expected conditions is deemed likely. This is especially true of the water quality aspects and therefore a different driver of ecological response, which most likely has a different hydrogeological origin, and as such will have different characteristics to that expected at the Tshipi Borwa Mine;
- **Temporal variability:** Aquatic and terrestrial ecosystems are dynamic and complex. It is likely that aspects, some of which may be important, could have been overlooked. The data presented is based on a single site visit, undertaken in summer (January 2019). The effects of natural seasonal and long-term variation in the ecological conditions and aquatic biota found in the streams (at analogous sites) are, therefore, unknown. The data gathered is however deemed acceptable for strategic decision making;

- **Artificial nature of the systems:** The two analogue sites assessed are artificially derived systems and over an extended period of time fish have been introduced into the systems by anglers, as well as through potential domestic escapee introductions. It follows that the fish community composition of the analogue sites must be considered with caution as it is not entirely representative of the local and regional ichthyofaunal assemblage; and
- **Regional Aquatic Ecology:** Although data sources are used provide useful and often verifiable, high quality data to define the regional aquatic ecology; the various databases used do not always provide an entirely accurate indication of the actual site-specific characteristics. However, this information is considered useful as background information. This, data was therefore used as a guideline to ensure the most appropriate outcome from a freshwater resource management perspective.

The following points serve to indicate the assumptions and limitations of the terrestrial study (SAS, May 2019):

- **Availability of analogous reference site:** Two analogous sites were assessed each presenting varied ecological characteristics. It must be noted that each site assessment was conducted at a high level and not in detail. The assessment was undertaken to allow the terrestrial habitat functioning in terms of the greater landscape to be determined and understood, so as to better inform and determine the perceived viability of the proposed Tshipi pit lake;
- **Temporal variability:** Terrestrial ecosystems are dynamic and complex by nature. It is likely that aspects, some of which may be important, could have been overlooked. The data presented is based on a single site visit, undertaken in summer (January 2019). The effects of natural seasonal and long-term variation in the ecological conditions are, therefore, unknown, however the data gathered is deemed acceptable for strategic decision making; and
- Not all the species at each site were assessed, instead a rapid assessment combined with previous studies from the area and background data was used to derive an understanding of the functioning and importance of each analogue site, however the data gathered is deemed acceptable for strategic decision making.

14.6 SOILS AND LAND CAPABILITY

The following assumptions and limitations were made for the soils and land capability study (Terra Africa, May 2019):

- It is assumed that the water available at the end of the project will be of sufficient quality for use; and
- It is assumed that the quantity of water with the pit lake is sufficient to support alternative land uses such as aquaponics and intensive irrigation.

14.7 AIR

The following assumptions and limitations were made for the air study (Airshed, June 2019):

- Meteorological data: No onsite meteorological data was available and modelled MM5 data for the study site was obtained for the period January 2015 – December 2016;

- Tshipi Mine operates a dustfall network comprising of five (5) single dustfall units and five (5) directional dustfall units. Since results from the directional units cannot be compared to the NDCR limits, and only results from the single dustfall units are reported on. Monthly dustfall results were provided for the period January 2017 to April 2018, with no monthly results thereafter. The annual report for 2018 was made available but only reported on the minimum; average and maximum rates;
- PM_{10} is also measured at and around the mine and results were made available for the period October 2015 to May 2018, but with no data provided for the remainder of 2018 and for 2019;
- Current Mining Operations:
  - The current mining operations were not assessed. The impact assessment conducted as part of the 2009 EIA was regarded representative of the current mining operations, including a discussion on the waste rock dump expansions and additional infrastructure addressed in the EIA/EMPR revisions in 2016 and 2018; and
  - It was further assumed that in-pit dumping occurs concurrently with the current mining operations and that this would have ceased during the closure phase.
- Closure Option:
  - It was assumed that during closure, windblown dust from the remaining waste rock dumps would be the main source of air pollution. It is likely that there will be intermittent truck activities and materials handling as part of the final rehabilitation, but these could not be quantified and were qualitatively described. The quantification of sources of emission was for Project activities only. Background sources were not included;
  - It was further assumed that in-pit dumping occurs concurrently with the current mining operations and that this would have ceased during the closure phase;
  - It was assumed that the tailings storage facility will not be on-site at the time of closure;
  - The windblown emissions from the waste rock dump were based on particle size distribution data obtained from material samples taken at the Western and Eastern waste rock dumps. For the remaining dumps the average particle size distribution was applied;
  - Gaseous emissions from vehicle exhaust and other auxiliary equipment were not quantified as the impacts from these sources are usually localized and unlikely to exceed health screening limits outside the project area. The main pollutant of concern from the closure phase is particulate matter;
  - The impact assessment was limited to airborne particulate (including TSP, PM_{10} and $PM_{2.5}$); and
  - There will always be some degree of uncertainty in any geophysical model, but it is desirable to structure the model in such a way to minimize the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere. Nevertheless, dispersion modelling is generally accepted as a necessary and valuable tool in air quality management.

14.8 NOISE

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

14.9 VISUAL STUDY

The following assumptions and limitations are relevant to the visual study (Graham Young Landscape Architects, June 2019):

- The extent of the study area is determined by the zone of potential influence, which in this study relates to a radius of 10 km around the project site. At 10 km and beyond the project would recede into background views and or be screened by existing vegetation, mining operations or infrastructure;
- The description of project components is limited to what has been supplied to the author prior to the date of completion of this report;
- No alternatives to the project layout and site have been proposed – only the preferred option at closure has been assessed; and
- The visual sensitivity to the project is assumed to be low due to the context of the project site (mining activities in the immediate area) and that during the public participation process visual issues where not raised as a concern (SLR 2019).

14.10 ECONOMIC STUDY

The following assumptions and limitations apply to the economic study (Mercury, June 2019):

- Present Value calculation assumed revenue received at the end of each period;
- Present Value of the proposed underground mining project, assumed the present year as year zero, even though the proposed project may only be considered once the open pit resources have been depleted, which is expected after 20 years from the present year;
- A discount factor (a financial factor which, when multiplied by a predicted future cash flow from a loan or some other form of debt, gives its present value) of 10% was used to calculate the net present value calculations;
- Capital, revenue and labour information for the underground mining project was limited to the first 25 years of life of mine. The life of mine is estimated at 55 years. The potential economic gain from the underground operations may therefore be much greater than the value that was stated in the report.
- The underground mining project's economic viability is based upon current financial condition and markets. This may however change once the project is due for implementation;
- The information (capital investment, operational expenses and labour) supplied by NRD Technologies regarding the backfilling of the pit utilising a conveyor system was assumed to be an accurate reflection;
- The cost estimates for accessing the underground reserves via a vertical shaft from surface as undertaken in the METS conceptual study was based on a +/-35% level of confidence;

- The METS study incorporated the capital costs for the sinking and equipping of a vertical shaft from surface, two services shaft and the establishment of surface infrastructure. The study excluded an incline shaft and development capital.
- To determine the economic factors for cattle grazing as an alternative land use, a carrying capacity of 1 head of cattle for every 30 hectares, a calving ratio of 82% and 1 employee per every 100 hectares was assumed. In all the scenarios this was however not a feasible alternative as the employment is in excess of the revenue. This portion of land will therefore have to be incorporated with a larger neighbouring farming business, if that possibility exists;
- An average wage of R3 169 for farmworkers was used as supplied by the Department of Labour;
- The scope of work for the economic assessment did not include a review of the rehabilitation liability, financial provision, operational and capital business plans;
- The economic contribution of the pre-mining land use activities was not assessed; and
- No detailed feasibility study was provided for an aggregate crushing operation and therefore no economic indicators could be determined.

14.11 FINANCIAL PROVISION

The following assumptions are made for the development of the Preliminary Closure Plan (SLR, June 2019a):

- Tshipi will follow and adhere to the commitments made in the EIA and EMP reports, and any amendments there to.
- Tshipi will follow the mine plan and design /layout to minimise the potential for additional disturbed areas.
- The volume of stockpiled topsoil [1] that has been stripped from infrastructure and operational areas will be sufficient for closure 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.
- Hazardous material can be safely disposed of offsite at a nearby appropriate facility.
- Reagent, fuel, lubricant and explosive manufacturers/suppliers will accept returned product at the end of the mine life.
- No consideration of the social closure costs has been included in this report.
- No assessment of any socio-economic/shared value/ community based programmes being implemented and whether these would continue post-closure of the operation.

[1] There are currently two topsoil stockpiles on site. Stockpile near the Northern dump (700,800 m^3) and Stockpile near the railway loop (47,025 m^3).

- All costs associated with pre-closure monitoring, auditing and reporting are presumed to be covered under the operations expenditure of the mine, and have not been included in this preliminary closure plan.

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

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

15.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the biophysical and socio-economic environments both on the project sites and in the surrounding area. With management actions, these potential impacts can be prevented or reduced to acceptable levels and in some instances (eg. loss and sterilisation of mineral resources, physical and general disturbance of biodiversity and economic) the signification of the impacts with mitigation can become positive. It follows that provided the EMPr is effectively implemented there is no biophysical, social or economic reason why the project should not proceed.

15.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

15.2.1 SPECIFIC CONDITIONS FOR INCLUSION IN THE EMPR

Refer to Section 13.

15.2.2 REHABILITATION REQUIREMENTS

Refer to Section 27.

16 PERIOD FOR WHICH AUTHORISATION IS REQUIRED

The environmental authorisation is required for the LOM. The mine has a remaining LOM of 25 years and has been operational for 7 years.

17 UNDERTAKING

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

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

Signature of EAP

Date 30/09/2019

Signature of commissioner of oath

Date 30/09/2019

Signed this 30 day of 09/2019
ALEXANDER GROSVENOR SHORT BComm(Hons) CA(SA)
08110611
1 MACBETH AVENUE, FOURWAYS
COMMISSIONER OF OATHS
(011) 706 0080

18 FINANCIAL PROVISION

18.1 METHOD TO DERIVE THE FINANCIAL PROVISION

The closure cost liability was calculated in accordance with the proposed Financial Provisioning Regulations, 2019 (Government Gazette 42464, 2019) for mining operations (Appendix M). It is important to note that the amount to be set aside for the current closure and rehabilitation of the Tshipi Borwa Mine (current value (CV) as at June 2019), in accordance with the current 2015 Financial Provisioning Regulations is also provided for.

The amount determined for financial provision for the project is provided in Section 27.

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

The amount required in order to manage and rehabilitate the environmental impacts is determined for financial provision (see section 18.1) can be provided for i.e. there is adequate revenue and will be provided for in the mines' operating costs of budget, if the project is approved.

19 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

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

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

No person will be directly affected by the project given that no I&APs currently reside at the mine. However, other direct impacts include:

- Safety to third parties and animals (**LOW** significance with mitigation);
- Road and traffic safety (**expected to be negligible**);
- Influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security (**expected to be NEGLIGIBLE**); and
- Employment and procurement of goods and services (**expected to be NEGLIGIBLE**).

Indirect socio-economic impacts include:

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

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

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

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

No other matters are required in terms of Sections 24(4)(A) and (B) of NEMA.

PART B - ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

21 DETAILS OF THE EAP

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

22 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

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

23 COMPOSITE MAP

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

24 DESCRIPTION OF THE IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENT

24.1 DETERMINATION OF CLOSURE OBJECTIVES

The closure objectives for the project were determined taking into account the existing type of environment as described in Section 7.4.1, in order to ensure that to a certain degree the closure objectives strive to achieve a condition approximating its natural state as far as possible. In addition to this, the closure objectives were also informed through input from specialists that have identified the possibility of sustainable alternative land uses at closure. Further information pertaining to the closure objectives identified for the proposed project is provided in Section 27.1.1.

24.2 VOLUMES AND RATE OF WATER USE FOR MINING

This section is not applicable. The proposed project is focussed on the closure phase and as such no mining related activities will take place at closure.

24.3 HAS A WATER USE LICENCE BEEN APPLIED FOR?

A water use licence has not been applied for a part of the proposed project because no licence is required at this stage. In future, Tshipi or alternative future land owners may have to obtain the relevant water use licence authorisations such as abstraction of pit lake water (Section 26).

24.4 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The assessment of potential impacts is included in Section 9 and Appendix E. Management actions which will be implemented to avoid and minimise potential impacts are detailed in Section 26. The table below outlines management measures to mitigate the listed activity only.

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

Activity	Phase	Size and scale of disturbance	Mitigation measures	Compliance with standards	Time period for implementation
GNR 983. Listing Notice 1: Activity 24: The development of a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters (but excluding a road which is one kilometre or shorter) *Establishment of a 30m wide road that is longer than one kilometre.*	Decommissioning Closure	Road will be a re-purposed haul-ramp and is estimated to be 30 m wide with a length of approximately 2.5km (7.5 ha).	• Tshipi must implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These relate to on-going road maintenance; and • In case of a person or animal being injured by transport activities the emergency response procedure in Section 29.2.2 will be followed.	Not applicable	On-going As required

25 IMPACT MANAGEMENT OUTCOMES

Table 25-1 below provides a description of the outcomes and objective of management actions in order to manage, remedy, control or modify potential impacts. The management actions identified to achieve these outcomes and objectives are described in Section 26.

TABLE 25-1: DESCRIPTION OF IMPACT MANAGEMENT OUTCOMES

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
• Partially open pit (result of in-pit dumping) • Raw (un-rehabilitated) waste rock dumps remaining on surface until mining ceases.	Loss and sterilisation of mineral resources	Geology (mineral resources)	Closure	• Manage through effective planning and execution of concurrent backfilling only (In-pit dumping)	• The environmental objective is to prevent unacceptable mineral sterilisation. • The environmental outcome is to minimise the sterilisation of economic minerals as far as possible.
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Safety to third party and animals	Topography	Decommissioning Closure	• Manage through implementing approved EMPr • Removal of potential hazardous infrastructure (except waste rock dumps) • Remedy through rehabilitation of waste rock dumps • Control by making the open pit safe • Remedy through emergency response procedure	• The environmental objective is to minimise changes to natural topography • The environmental outcome is to limit the alteration of the topography during mining and through rehabilitation.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
• Decommissioning activities • Waste rock dumps remaining on surface	Loss of soil resources and land capability through contamination	Soil and land capability	Decommissioning Closure	• Manage through implementing approved EMPr • Remedy through rehabilitation • Remedy through emergency response procedure	• The environmental objective is to minimise the loss of soil resources and related land capability through physical disturbance, erosion, compaction and soil pollution • The environmental outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation in order to support post closure land capability.
• Decommissioning activities • Waste rock dumps remaining on surface	Loss of soil resources and land capability through physical disturbance		Decommissioning Closure	• Manage through implementing approved EMPr • Remedy through rehabilitation • Manage through design of permanent landforms Management through post closure monitoring	
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Physical destruction of biodiversity	Biodiversity	Decommissioning Closure	• Manage through implementing approved EMPr • Management through establishment of sustainable aquatic and terrestrial habitats • Management through post closure monitoring	• The environmental objective is to prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical and general disturbance. • The environmental outcome is to limit the area of disturbance as far as practically possible and create and enhance aquatic
• Decommissioning activities • Partially open pit (result of in-pit dumping)	General disturbance of biodiversity		Decommissioning Closure	• Manage through implementing approved EMPr • Management through	

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
• Waste rock dumps remaining on surface				post closure monitoring	and terrestrial habitats
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Alternation of natural drainage pattern	Surface water	Decommissioning Closure	• Remedy through removal of infrastructure (except waste rock dumps) • Remedy through rehabilitation of waste rock dumps	• The environmental objective is to prevent unacceptable alteration of drainage patterns. • The environmental outcome is to ensure that the reduction of the volume of runoff into the downstream catchment is limited to what is only necessary and that natural drainage patterns are re-established as part of rehabilitation where possible in order to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.
• Decommissioning activities • Partially open pit (access to pit lake) • Waste rock dumps remaining on surface	Contamination of surface water resources		Decommissioning Closure	• Manage through implementing approved EMPr • Remedy through implementation of the topography/topsoil and revegetation plans • Manage through post closure monitoring	• The environmental objective is to prevent surface water contamination. • The environmental outcome is to ensure that the water quality within the pit lake remains acceptable for livestock watering purposes.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
				• Manage and remedy through installation of floating wetlands • Remedy through compensation in the event of loss to third parties • Remedy through emergency response procedures	
• Cessation of dewatering	Lowering of groundwater levels	Groundwater	Decommissioning	• Manage through post closure monitoring • Remedy through compensation in the event of loss to third parties	• The environmental objective is to prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users. • The environmental outcome is to ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that groundwater continues to be available to current users.
• Waste rock backfilled into the open pit as part of in-pit dumping • Waste rock remaining on surface	Contamination of groundwater resources		Closure	• Manage through implementing approved EMPr • Management through post closure monitoring • Remedy through compensation in the event of loss to third parties	
• Short term decommissioning activities • Waste rock dumps remaining on surface	Air pollution	Air	Decommissioning Closure	• Manage through implementing approved EMPr • Management through post closure monitoring	• The environmental objective is to prevent air pollution health impacts. • The environmental outcome is to ensure that any

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
					pollutants emitted as a result of the project remains within acceptable limits so as to prevent health related impacts
• Post closure monitoring, aftercare and maintenance	Increase in disturbing noise levels	Noise	Closure	• Management through maintenance of equipment and vehicles • Management through noise attenuation for trucks and vehicles • Manage through noise activities during the day time only	• The environmental objective is to prevent public exposure to disturbing noise. • The environmental outcome is to ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Negative visual views	Visual	Decommissioning Closure	• Manage through implementing approved EMPr • Remedy through rehabilitation • Management through post closure visual assessments	• The environmental objective is to limit negative visual impacts • The environmental outcome is to limit negative visual views
Not applicable	Road disturbance and traffic safety	Traffic	Closure	• Manage through implementing approved EMPr • Remedy through emergency response procedures	
Not applicable	Loss of heritage/cultural and palaeontological resources	Heritage/cultural and palaeontological	Closure	• Management through chance find procedures	• The environmental objective is to minimise the

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
		resources		• Remedy through emergency response procedures	disturbance of heritage and palaeontological resources • The environmental outcome is to protect heritage and palaeontological resources where possible. In the event of a chance find, consult with a specialist and the SAHRA and in line with regulatory requirements
Not applicable	Inward migration	Socio-economic	Closure	• Manage through implementing approved EMPr	• The environmental objective is to limit inward migration and related social impacts and enhance positive economic impacts • The environmental outcome is to work with existing structures and organisations to establish and maintain a good working relationship with surrounding communities, local authorities and landowners in order to limit the impacts associated with inward migration. Enhance the positive economic impacts by accessing future underground resources
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Economic impact		Decommissioning Closure	• Manage through implementing approved EMPr • Manage though effective planning and execution of concurrent backfilling only (In-pit dumping)	
• Decommissioning	Change in land use	Land use	Decommissioning	• Manage through	• The environmental objective

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface			Closure	implementing approved EMPr • Remedy through rehabilitation	is to prevent unacceptable negative impacts on surrounding land uses • The environmental outcome is to minimise the impact on land uses as little as possible in order to prevent unacceptable impacts on surrounding land uses and their economic activity

26 IMPACT MANAGEMENT ACTIONS

Management actions identified to prevent, reduce, control or remedy the assessed impacts are presented in Table 26-1 below. The action plans include the timeframes for implementing the management actions together with a description of how management actions comply with relevant standards. It is important to note that management actions will include any measures outlined in the approved EMPr (SLR, August 2017) and any additional management actions identified by specialists have been summarised and are included in the table below. Any additional management actions will be indicated in *italics.*

TABLE 26-1: DESCRIPTION OF IMPACT MANAGEMENT ACTIONS

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
• Partially open pit (result of in-pit dumping) • Raw (un-rehabilitated) waste rock dumps remaining on surface until mining ceases.	Loss and sterilisation of mineral resources	• *Planning and execution of concurrent backfilling (in-pit dumping) to achieve most efficient opportunities to access the underground mineral resources in future as well as maximising safety and establishment of biodiversity habitats. This will happen during the operational phase through to the decommissioning phase.* • *Planning and execution of waste rock dumping to maximise access to selected waste rock for crushing and screening and sale as construction material.*	On-going On-going	Not applicable
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Safety to third party and animals	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr (SLR, August 2017 and April 2019). These management actions focus on rehabilitation and limiting the footprint of disturbance; • At closure *all potentially hazardous surface infrastructure except the waste rock dumps and pit* will have been removed. This will happen at the end of the operations phase and in the decommissioning phase; • *Waste rock dumps will be* rehabilitated in a manner that it does not present a long term safety and/or stability risk. *In addition to this, planning and execution of waste rock dumping to maximise opportunity for rehabilitation concurrent with mining must be implemented.* This will commence in the operations phase and will continue through to the closure phase; • *Tshipi will ensure that the partially open pit will be made and kept safe. This will commence in the operations phase and will continue through to the closure phase. Actions include:*	On-going As required On-going On-going	Implement the rehabilitation plan as outlined in the Financial provision regulations published in 20 November 2015. This includes updating the rehabilitation plan annually. The rehabilitation plan is included in Section 27.1.3.

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		o *Ensuring that the final pit slopes design maintains long term stability performance;* o *The top bench slope of the pit (i.e. to roughly 10m below natural ground level to (1V:3H) is maintained and where possible a lesser gradient. Sloped area must be top soiled and re-vegetated;* o *The 2m high exclusion berm around the high wall side of the pit is constructed and maintained;* o *Fencing and warning signs with images and appropriate languages located along the high wall berm to prevent inadvertent access; and* o *Access to the pit lake will only be via the converted haul-ramp that will be constructed to ensure the safety of third parties and animals.* • In case of incident or death due to hazardous excavations and infrastructure, the emergency response procedure in Section 29.2.2.1 will be followed.	As required	
• Decommissioning activities • Waste rock dumps remaining on surface	Loss of soil resources and land capability through contamination	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on pollution prevention through the implementation of waste management procedures for the storage, handling and disposal of general and hazardous waste; • During Closure, specifications for post rehabilitation auditing will be determined and implemented to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures; and • In case of major spillage incidents the emergency response procedure in Section 29.2.2 will be followed.	On-going As required As required	Not applicable
• Decommissioning activities • Waste rock dumps remaining on surface	Loss of soil resources and land capability through physical disturbance	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on implementing the soil conservation procedure (stripping, stockpiling, erosion control and stockpile management), rehabilitation and limiting the area of disturbance to what is necessary; • Rehabilitation will be undertaken in line with an approved mine closure plan that ensures a suitable post-closure land use is achieved. This will happen during the decommissioning phase;	On-going As required	Not applicable

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		• As part of closure planning, the designs of any permanent landforms (waste rock dumps) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring. This will happen during the decommissioning phase; and • *Post closure erosion monitoring and aftercare until no longer deemed necessary.*	As required As required	
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Physical destruction of biodiversity	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on: o Implementing the biodiversity action plan; o Limiting vegetation clearing; o Re-vegetation of disturbed areas no longer in use; o Monitoring of protected trees; o Obtaining permits for the removal of protected trees and/or plants; and o Implement a biodiversity offset if requested by DAFF. • *To ensure a sustainable aquatic system which supports biodiversity and ecology of the area, suitable habitats will be created within the pit-lake. This will happen in the decommissioning phase through to the closure phase. Design and management as detailed in Section 3.2.6 include:* o *The creation of shallows;* o *The creation of gravel beds and scree slopes;* o *The introduction of aquatic vegetation;* o *The introduction of desirable fish species; and* o *The construction of floating wetlands.* • *Ensure that the design criteria and methods to enhance support of post closure terrestrial ecology as outlined in Section 3.2.7 is implemented. This will happen during the decommissioning phase through to the closure phase. Design and management criteria as detailed in Section 3.2.7 includes:* o *Implementing the topography and topsoil plan outlined in Section 3.2.7.1 which focusses on:* – *Ripping of hardened surfaces;* – *Replacement of topsoil and appropriate soil depth to promote vegetation growth;* – *Sloping and netting of waste rock dumps to promote revegetation; and*	On-going As required As required	Permit applications will have to be made to the DAFF and DENC to obtain the required permission to remove and/or translocate protected species in terms of the NFA and the NCNCA respectively.

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		– *Ensuring final closure plans and designs do not prohibit movement of species.* o *Implement the revegetation plan outlined in Section 3.2.7.2 which focusses on:* – *Re-vegetation using trees and shrubs endemic to the area;* – *Collective seeding;* – *The use of seed mixes;* – *Reseeding timing; and* – *Control of alien and invasive species.* • *A suitably qualified aquatic ecologist will be consulted during the design of the aquatic and terrestrial habitats. This will happen during the decommissioning phase through to the closure phase; and* • *Conduct post closure biodiversity monitoring as outlined in Section 28 during the closure phase until it is no longer deemed necessary.*	As required As required	
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	General disturbance of biodiversity	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on rehabilitation, implementing the alien and invasive species programme, zero tolerance killing policy, veld fire prevention; speed control, maintenance of noise equipment, dust control and pollution prevention; and • *Conduct post closure biodiversity monitoring as outlined in Section 28. This will happen during the closure phase. In terms of the deep rooted plants such as the Camel Thorn and Grey Camel thorn, should monitoring results indicated that the growth of the trees within the pollution plume is compromised, the re-vegetation plan needs to be adjusted, where necessary*	On-going As required	The management action to implement an alien invasive species programme is in accordance with the NEMBA Alien and Invasive Species Regulations (2016) that requires the control of invasive species.
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Alternation of natural drainage pattern	• *Once all infrastructure, equipment and services have been removed, the remaining surface areas will be landscaped, topsoiled and revegetated to promote natural drainage patterns. This is mainly in the decommissioning phase; and* • *Once the waste rock dumps have been rehabilitated successfully, the toe paddocks will be removed. This will happen in both the decommissioning and closure phases.*	As required As required	Not applicable

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
• Decommissioning activities • Partially open pit (access to pit lake) • Waste rock dumps remaining on surface	Contamination of surface water resources	• In order to address various potential pollution sources associated with decommissioning activities, Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on pollution prevention (collection, storage and disposal of hazardous waste), implement the stormwater management plan, regular inspection and maintenance of water management facilities and waste rock dumps and maintenance and servicing equipment and vehicles;	On-going	Operate stormwater management facilities so as to comply with Regulation 704 of 1999 in terms of the NWA.
		• *During operations, decommissioning and the initial part of the closure phase, surface water run-off and seepage paddocks will be installed and maintained around all waste rock dumps;*	On-going	
		• *Tshipi will implement the topography/topsoil and revegetation plans during the decommissioning phase as outlined in Sections 3.2.7.1 and 3.2.7.2. Once rehabilitated the final land forms are unlikely to erode and/or contribute to pollution run-off. Once this is confirmed, the run-off containment toe paddocks around the waste rock dumps can be removed and rehabilitated;*	As required	
		• During the decommissioning phase *and the initial monitoring and aftercare part of the closure phase*, Tshipi will continue to implement a monitoring programme for surface water resources. This includes monitoring both up and downstream of the Vlermuisleegte when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme is outlined in Section 28;	As required	
		• *Once mining activities cease in the pit and sufficient water is available (during the closure phase), a floating wetland system will be implemented using a combination of vegetation types and surface area coverage that will enable the treatment of the pit lake water to meet DWS livestock watering objectives. Research, references and modelling indicate that this can be a successful treatment solution, but final design, maintenance requirements and related monitoring will be determined only on the basis of implementation on site. In this regard, final closure planning will be sufficiently flexible to allow for the following:* o *Ongoing optimisation and improvement of the floating wetland system;* o *Adaptation to changing circumstances that might require*	As required	

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		implementation of alternative and/or additional treatment technologies; and o *Contingency planning in the event that water treatment becomes ineffective at some point in future and access to/use of the pit lake requires reconsideration.* • *During the closure phase, monitoring the pit lake water quality will be undertaken. Details of the surface water monitoring programme is outlined in Section 28;* • During the decommissioning and the monitoring and aftercare part of the closure phases, should any surface water resource contamination be detected, the mine will immediately notify DWS. Tshipi, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users (eg. farmers using the water for livestock watering), identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures. Any related loss caused by Tshipi (in the short and long term) will be addressed through compensation, which may include an alternative water supply of equivalent quality and quantity; and • Implement the emergency response procedure in Section 29.2.2 in the event of a potentially polluting discharge incident.	As required As required As required	
• Cessation of dewatering	Lowering of groundwater levels	• Tshipi will continue to monitor groundwater levels (refer to Section 28 for the monitoring programme); and • In the unlikely event that borehole users experience any additional post closure mine related water loss, Tshipi will provide compensation, which could include an alternative water supply of equivalent water quality and quantity. This will happen during the closure phase.	As required As required	Not applicable
• Waste rock backfilled into the open pit as part of in-pit dumping • Waste rock remaining on surface	Contamination of groundwater resources	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on implementing the stormwater management plan, pollution prevention through appropriate infrastructure design of waste rock dumps and updating the groundwater model; • Post closure ground water monitoring will be undertaken until it is no longer deemed necessary. The post closure monitoring programme is included in Section 28; and • If water users experience any Tshipi related contamination, Tshipi will provide compensation, which could include an alternative water	On-going As required As required	Not applicable

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		supply of equivalent water quality. This commitment extends into the closure phase.		
• Short term decommissioning activities • Waste rock dumps remaining on surface	Air pollution	• Tshipi must implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on speed control, use of dust binding agents and/or dust suppression (roads), water sprays at loadings and conveyor points; and • *The current monitoring programme for dust fallout and PM_{10} and $PM_{2.5}$ (Section 28) at the Tshipi Borwa Mine should be extended post closure until such time that it is not deemed necessary. This can only be determined by a qualified specialist.*	On-going As required	National Atmospheric Emission Reporting Regulations in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004) requires that holders of mining rights register on the National Atmospheric Emissions Inventory System (NAEIS) and to ensure that annual monitoring reports are uploaded onto the NAEIS.
• Post closure monitoring, aftercare and maintenance	Increase in disturbing noise levels	• *All diesel-powered equipment and vehicles should be kept at a high level of maintenance / in a good state of repair. This should particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance;* • *Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels;* • *In managing noise specifically related to truck and vehicle traffic, efforts should be directed at:* o *Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program;* o *Maintain road surface regularly to avoid corrugations, potholes etc;* o *Avoid unnecessary idling times;* o *Minimising the need for trucks/equipment to reverse, through appropriate traffic management plans. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. Alternatives to the traditional reverse 'beeper' alarm such as a 'self-adjusting' or 'smart' alarm could be considered. These*	On-going On-going On-going	Not applicable

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		alarms include a mechanism to detect the local noise level and automatically adjust the output of the alarm is so that it is 5 to 10 dB above the noise level near the moving equipment. The promotional material for some smart alarms does state that the ability to adjust the level of the alarm is of advantage to those sites 'with low ambient noise level'; o *Limiting traffic to hours to between 06:00 and 18:00.* • *Where possible, other non-routine noisy activities likely to occur should be limited to day-time hours;* • A noise complaints register must be kept as relevant; and • Investigative short term ambient noise measurements could potentially be conducted only in the highly unlikely event that post closure activities lead to material noise related complaints	As required On-going As required	
• Decommissioning activities • Partially open pit • Waste rock dumps remaining on surface	Negative visual views	• Tshipi must implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on maintenance of equipment and haul roads, appropriate equipment operation and responding to noise related complaints; • *Tshipi will commence with the rehabilitation of the waste rock dumps during the operational phase of the mine; and* • During closure final rehabilitated areas and facilities remaining in perpetuity will be managed through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.	On-going On-going As required	Not applicable
Not applicable	Road disturbance and traffic safety	• In case of a person or animal being injured by transport activities the emergency response procedure in Section 29.2.2 will be followed.	On-going	Not applicable
Not applicable	Loss of heritage/cultural and palaeontological resources	• During the decommissioning and closure phases, prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance, Tshipi will engage a professionally registered heritage and/or palaeontological specialist to make associated recommendations that Tshipi will comply with; and • If there are any chance finds of heritage/ cultural or paleontological sites, Tshipi will follow the emergency response procedure (Section 29.2.2).	As required As required	Compliance with the National Heritage Resource Act (No. 25 of 1999) in the event of any chance finds
Not applicable	Inward migration	Management actions to be implemented in include the implementation of the management measures as outlined in the approved EMPr (SLR). These management actions focus on recruitment processes, communication and	On-going	Not applicable

Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
		health awareness training		
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Economic impact	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on clear communication, recruitment and procurement processes; and • *Planning and execution of concurrent backfilling only (in-pit dumping) to achieve most efficient opportunities to access underground mineral resources in future. This will happen during the operational phase through to the decommissioning phase.*	On-going On-going	Not applicable
• Decommissioning activities • Partially open pit (result of in-pit dumping) • Waste rock dumps remaining on surface	Change in land use	• Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on communication with neighbouring communities, land users, and land owners to facilitate information sharing; • Rehabilitate the overall site to provide for the post closure land use in accordance with the mine Closure Plan. This will happen during the decommissioning phase and will carry through to the closure phase; • Tshipi will comply with the relevant NEMA provisions regarding closure; and • Tshipi will comply with the relevant NEMA provisions regarding financial provision for rehabilitation.	On-going As required As required As required	Implement the rehabilitation plan as outlined in the Financial provision regulations published in 20 November 2015. This includes updating the rehabilitation plan annually. The rehabilitation plan is included in Section 27.1.3.

27 FINANCIAL PROVISION

This preliminary closure plan has been prepared in accordance with GNR 1147 of the National Environmental Management Act (107/1998): Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations, published 20 November 2015 (Financial Provisioning Regulations, 2015).

27.1 DETERMINATION OF THE AMOUNT OF THE FINANCIAL PROVISION

27.1.1 CLOSURE OBJECTIVES DESCRIPTION AND THE ALIGNMENT WITH THE BASELINE ENVIRONMENT

The preliminary closure plan objectives and principles include the following:

- To create a functioning ecosystem that supports a sustainable end land use;
- To ensure a suitable pit lake quality for livestock watering and biodiversity;
- Environmental damage is 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 impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised.

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

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

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

The closure objectives are outlined in this report which will be made available to I&APs for review and comment (Section 7.2). In addition to this, the closure objectives associated with the proposed project were presented to I&APs and commenting authorities during the public meeting and focussed meetings.

27.1.3 REHABILITATION PLAN

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 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.
- 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 instruments.

Annual rehabilitation plans for the forthcoming 12 months will be prepared in future updates of this report.

Annual rehabilitation and remediation activities associated with the annual rehabilitation plan will focus primarily on:

- 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 operation), and retaining as much natural vegetation as possible.
- Stripping and stockpiling of soil resources in areas designated for development in line with a soil conservation procedure.
- Backfilling of mined out pit areas (i.e. in-pit dumping during operations) in accordance with the mine plan.
- Rehabilitation of overburden dumps (no longer required) that are expected to remain post closure.
- General, hazardous and medical waste collection, storage and disposal.
- Ongoing monitoring of groundwater, surface water and air quality.

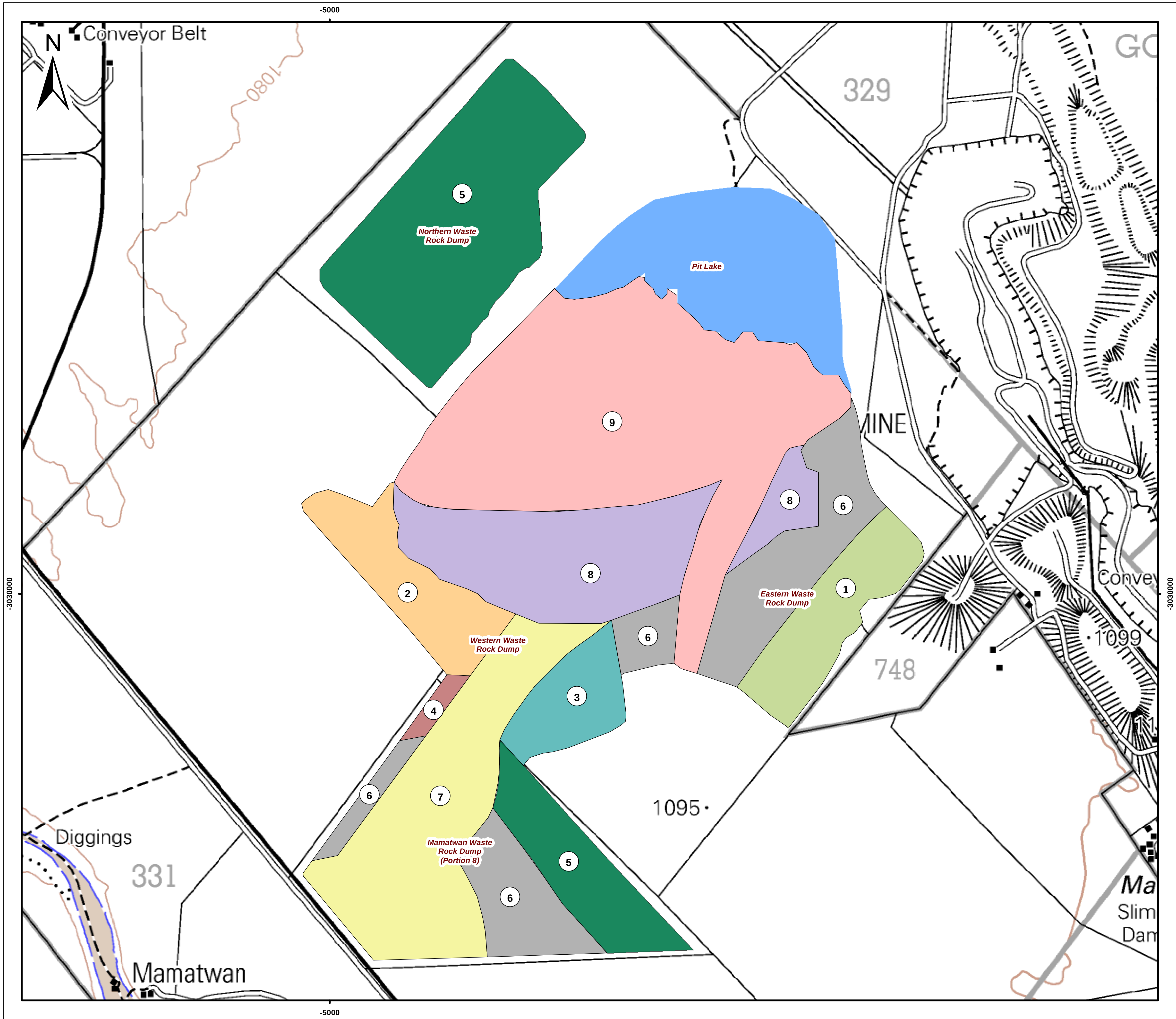
A preliminary plan indicating the potential areas of concurrent rehabilitation of the waste rock dumps (based on the latest mining schedule) is shown in Figure 16, and summarised in the table below.

TABLE 27-1: POTENTIAL WRD AREAS FOR CONCURRENT REHABILITATION

Area Available	Date available for Concurrent Rehabilitation	Location of Area(s)
29.20 ha	2022	• Southern section of Eastern WRD
27.80 ha	2023	• Northern section of Western WRD
19.46 ha	2024	• Southern section of Western WRD
3.26 ha	2025	• North section of Portion 8 WRD
123.80 ha	2030 to 2033	• Northern WRD • Eastern section of Portion 8 WRD
73.76 ha	2034 to 2036	• Northern section of Portion 8 WRD • Central section of Portion 8 WRD

Area Available	Date available for Concurrent Rehabilitation	Location of Area(s)
		• Remainder of Eastern WRD • Area connecting Eastern and Western WRD's
79.88 ha	2037 to 2040	• Remainder of Portion 8 WRD • Remainder of Western WRD
65.34 ha	2041 to 2044	• In-pit dumping areas (mostly top flat surfaces)
148.06 ha *	At LOM (2044+)	• Remainder of in-pit dumping areas (mostly slopes)

* Some of this area may be available before LOM Closure for concurrent rehabilitation.



Areas Available For Concurrent Rehabilitation

- 1 — 2022 (29.20ha)
- 2 — 2023 (27.80ha)
- 3 — 2024 (19.46ha)
- 4 — 2025 (3.26ha)
- 5 — 2030 to 2033 (123.80ha)
- 6 — 2034 to 2036 (73.76ha)
- 7 — 2037 to 2040 (79.88ha)
- 8 — 2041 to 2044 (65.34ha)
- 9 — At LOM 2044+ (148.06ha)

0 400 800 Meters

Scale: 1:17 500 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 16

Concurrent Rehabilitation Plan

SLR
SLR Consulting (Africa) (Pty) Ltd
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710.20008.00069 | 2019/07/31

27.1.4 COMPATIBILITY OF THE REHABILITATION PLAN WITH THE CLOSURE OBJECTIVES

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

27.1.5 CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISION

The closure cost liability was calculated in accordance with the proposed Financial Provisioning Regulations, 2019 (Government Gazette 42464, 2019), namely:

- A third party will be employed to undertake the decommissioning and rehabilitation work;
- All costs are based on market related figures based on prevailing rates;
- Mine infrastructure asset salvage value has not been taken into account; and
- Provisional and general costs and contingencies as per the industry standard are included.

The closure cost liability calculations have been determined for the following periods (as per the proposed *Financial Provisioning Regulations, 2019* (Government Gazette 42464, 2019)), namely:

- Current closure cost liability (as at June 2019), R 186,488,203 (excl. VAT);
- The closure cost liability incurred over the next 12 months (i.e. from June 2019 to June 2020), R 15,505,059 (excl. VAT); and
- LOM closure cost liability, 25 years from now (as at June 2044), R 316,318,824 (excl. VAT).

In accordance with the 2nd Draft Financial Provision Regulations, the amount to be set aside for the current closure and rehabilitation of the Tshipi Borwa Mine (current value (CV) as at June 2019), is calculated to be R 268,680,158 (incl. VAT) as per the table below. The detailed financial provision report (SLR, June 2019a) is included in Appendix M.

TABLE 27-2: CURRENT CLOSURE LIABILITY PROVISION REQUIRED (SLR, JUNE 2019 A)

Aspect	Calculated Amount
Current Liability as at June 2019	R 186,488,203
Liability incurred over the next 12 months (June 2019 to June 2020)	R 15,505,059
Post closure maintenance and aftercare	R 17,382,250
Subtotal 1	**R 219,375,512**
Escalate Subtotal 1 by CPI + 2% (i.e. 6.5%)	R 14,259,408
Subtotal 2	**R 233,634,920**
Add 15% VAT to Subtotal 2	R 35,045,238
Grand Total	**R 268,680,158**

For comparative purposes, the amount to be set aside for the current closure and rehabilitation of the Tshipi Borwa Mine (current value (CV) as at June 2019), in accordance with the current 2015 Financial Provisioning Regulations is calculated to be **R 361 815 209.00 (incl. VAT)**.

Similarly, the amount to be set aside for the Life of Mine closure and rehabilitation of the Tshipi Borwa Mine (CV as at June 2019), is calculated to be **R 411 914 135.00** (incl. VAT) as per the table below.

TABLE 27-3: LOM CLOSURE LIABILITY PROVISION REQUIRED **(SLR, JUNE 2019A)**

Aspect	Calculated Amount
LOM Liability as at June 2044	R 316,318,824
Liability incurred over the next 12 months (June 2044 to June 2045)	R 0
Post closure maintenance and aftercare	R 20,006,250
Subtotal 1	**R 336,325,074**
Escalate Subtotal 1 by CPI + 2% (i.e. 6.5%)	R 21,861,130
Subtotal 2	**R 358,186,204**
Add 15% VAT to Subtotal 2	R 53,727,931
Grand Total	**R 411,914,135**

The overall level of confidence in the closure cost liability calculations can be further improved by:

- Confirming the demolition and removal of all infrastructure (including buildings, powerlines, water supply and treatment, access roads etc.);
- Maintaining a database of hazardous materials on site at closure, and the associated method (and hence cost) of safe disposal; and
- Obtaining site specific rates for the scheduled closure activities through a formal tender process with a detailed bill of quantities, detailed scope of work with engineered drawings, as well as, contract specifications.

27.1.6 CONFIRMATION THAT THE FINANCIAL PROVISION WILL BE PROVIDED

Currently, the financial provision is provided in the form of a Guardrisk Insurance guarantee. This policy will be extended to provide for the above once the project is approved.

28 MECHANISMS FOR MONITORING COMPLIANCE AND PERFORMANCE AGAINST THE EMPR

28.1 POST CLOSURE MONITORING PROGRAMME

Environmental impacts requiring monitoring are listed in Table 28-1 below.

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

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

Monitoring during the decommissioning phase needs to commence in accordance with the existing approved EMPr's (SLR, August 2017 and April 2019). The monitoring programme outlined in the section below applies to post closure monitoring only.

TABLE 28-1: POST CLOSURE MONITORING OF COMPLIANCE AND PERFORMANCE

<table>
<tr><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td colspan="5">WATER ASPECTS</td></tr>
<tr><td rowspan="2">Decommissioning activities
Waste rock dumps remaining on surface
Partially open pit (access to pit lake)</td><td rowspan="2">Contamination of surface water</td><td colspan="3">Ephemeral surface water courses and pit lake water quality</td></tr>
<tr><td> Monitoring of surface water quality will be undertaken in the event that surface water flow is present in the Vlermuisleegte River. In this regard, samples should be taken from both upstream and downstream of the Vlermuisleegte River. In addition to this, the sampling of the pit lake water quality must also be undertaken. Refer to Figure 17 for the location of the surface water monitoring points.
Water quality analyses results should be classified in terms of the SANS 241 (2015) Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996), or whichever is applicable at the time. The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). The parameters that need to be analysed are summarised in the table below.
<table>
<tr><td>pH</td><td>Surface water flow in the Vlermuisleegte
Pit lake</td></tr>
<tr><td>Conductivity in mS/m at 25 ° c</td><td>Surface water flow in the Vlermuisleegte
Pit lake</td></tr>
<tr><td>Temperature</td><td>Pit lake</td></tr>
<tr><td>Dissolved oxygen</td><td>Pit lake</td></tr>
<tr><td>Total dissolved solids (TDS) at 180 ° c</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Alkalinity as $CaCO_3$</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Carbonate as CO_3</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Bicarbonate as HCO_3</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Boron as B</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Nitrate as N</td><td>Surface water flow in the Vlermuisleegte
Pit lake</td></tr>
</table></td><td>Environmental Department</td><td> Monitoring will be undertaken when the Vlermuisleegte River is in flow.
Monitoring of the pit lake water quality will be undertaken for a minimum of 25 years. In this regard, quarterly monitoring will be required for the first 5 years, reducing to bi-annually for the next 10 years.
Monitoring reports need to be submitted to the DWS. </td></tr>
</table>

<table>
<tr><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td><table>
<tr><td>Chloride as Cl</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Sulphate as SO_4</td><td>Surface water flow in the Vlermuisleegte
Pit lake</td></tr>
<tr><td>Phosphate</td><td>Pit lake</td></tr>
<tr><td>Fluoride as F</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Sodium as Na</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Potassium as K</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Calcium as Ca</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Magnesium as Mg</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Manganese as Mn</td><td>Surface water flow in the Vlermuisleegte</td></tr>
<tr><td>Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS)</td><td>Surface water flow in the Vlermuisleegte
Pit lake</td></tr>
</table></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Floating wetlands</td></tr>
<tr><td></td><td></td><td>Monitoring of the effectiveness of the floating wetland needs to be undertaken by a qualified specialist. Monitoring of the floating wetland is required for a minimum of 25 years because the floating wetland system takes time to establish and the size of the wetland needs to be appropriate to treat the pit lake water to meet DWS livestock watering objectives.</td><td>Environmental Department or an appointed independent and suitably qualified and experienced specialist</td><td>Monitoring should be undertaken for a minimum of 25 years.</td></tr>
<tr><td>Waste rock backfilled into the open pit as part of in-pit dumping
Waste rock dumps remaining on surface</td><td>Contamination of groundwater resources</td><td>Post closure groundwater quality monitoring will be undertaken. Refer to Figure 17 for the location of the groundwater monitoring points. It is recommended that after the first 5 years of monitoring is complete, a qualified specialist is contacted to determine the possibility of reducing the number of boreholes that are monitored.

Water quality analyses results should be classified in terms of the SANS 241 (2015) Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996) or whichever is applicable at the time. The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). The parameters that need to be analysed are summarised in the</td><td>Environmental Department</td><td>Groundwater quality must be monitored will be undertaken for a minimum of 10 years. In this regard, monitoring is bi-annually monitoring is required for the first 5 years, reducing to annually for the next 5 years.</td></tr>
</table>

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
		table below. pH Conductivity in mS/m at 25 ° c Total dissolved solids (TDS) at 180 ° c Alkalinity as $CaCO_3$ Carbonate as CO_3 Bicarbonate as HCO_3 Boron as B Nitrate as N Chloride as Cl Sulphate as SO_4 Fluoride as F Sodium as Na * Potassium as K * Calcium as Ca * Magnesium as Mg * Manganese as Mn * Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS)		Monitoring reports need to be submitted to the DWS on an annual basis.
• Decommissioning activities • Open pit void • Waste rock dumps remaining on surface	Aquatic biomonitoring	**Whole Effluent Toxicity (WET) Testing - Biomonitoring**		
		In order to qualify and quantify the ability of water in the pit lake to support aquatic life and to assess possible acute effects on aquatic organisms, acute WET tests will be performed. The battery of WET tests must include: • *Daphnia pulex* (representing aquatic macro-invertebrates); • *Poecilia reticulata* (representing fish fauna); • *Vibrio fischeri* (representing bacteria); and • *Selenastrum capricornutum* (representing algae/aquatic macrophytes).		WET testing should be conducted bi-annually. Monitoring to be undertaken for a **minimum of 10 years.** Results to be submitted annually to the DWS.

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
		The *Selenastrum capricornutum* can also determine the risk of eutrophication of the system.		
		Eutrophication Testing - Biomonitoring		
		If a risk of eutrophication is becoming evident, based on physic-chemical data analyses and the results of the *Selenastrum capricornutum* test, further analyses to define the risk of eutrophication should be undertaken by means of determination of Chlorophyll a concentration and algal species identification	Environmental department	Eutrophication testing will form part of the toxicity testing and as such this will be undertaken bi-annually. Results to be submitted annually to the DWS.
		Habitat and Aquatic Macro-Invertebrate Assessment		
		An analysis of the aquatic macro-invertebrate community diversity, sensitivity and abundance will take place at an interval of every two years. In addition to the aquatic macro-invertebrate community assessment, a visual assessment of habitat conditions should be undertaken. The results should be compared temporarily to determine whether the trajectory of change is acceptable in terms of the desired outcomes. The monitoring plan will be continually updated and refined for site-specific requirements. All biomonitoring needs to be undertaken by a suitably qualified specialist.	Environmental department	An analysis of the aquatic macro-invertebrate community diversity, sensitivity and abundance should take place at an interval of every two years for a **minimum period of 10 years.** Visual assessments should be undertaken on an annual basis for a **minimum of 10 years.** Results to be submitted annually to the DWS.
TERRESTRIAL ASPECTS				
• Decommissioning activities	Terrestrial biodiversity monitoring	**Floral monitoring**		
		Implement a post closure floral monitoring plan. The following points aim to guide the design	Environmental	Monitoring will take place

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
• Open pit void • Waste rock dumps remaining on surface		of the monitoring plan: • Permanent floral monitoring plots will be established in the rehabilitated areas. These plots must be designed to accurately monitor the following parameters: o Measurements of the crown and basal cover; o Species diversity; o Species abundance; o Recruitment of indigenous species; o Alien vs Indigenous plant ratio; o Recruitment of alien and invasive plant species; o Effectiveness of alien and invasive plant control measures; o Erosion levels and the efficacy of erosion control measures; and o Vegetation community structure including species composition and diversity which should be compared to the previous round of monitoring. • The rehabilitation plans must be continuously updated in accordance with the monitoring results in order to ensure that optimal rehabilitation measures are employed; and • The method of monitoring will be designed to be objective and repeatable in order to ensure consistent results. All monitoring will be undertaken by a suitably qualified specialist.	department	on an annual basis for a **minimum of 10 years.**
		Faunal monitoring		
		In order to assess the effectiveness of the rehabilitation plans as well as the pit lake it is important that faunal species diversity, abundance and habitat use is assessed. Faunal monitoring will provide valuable insight into the effectiveness of the habitat creation and development, whilst also indicating the rate at which faunal species are recolonising the rehabilitated area. Monitoring will also indicate if the lake is serving its proposed purpose of providing aquatic habitats and breeding zones for faunal species, whilst also forming a useable water resource in the area. The following points aim to guide the design of the monitoring plan. It must be noted that the monitoring plan will be continually updated and refined for site-specific requirements: • Permanent monitoring points will be established in areas within the rehabilitated site in various habitat areas and degrees of topography i.e. banks/riparian zone of the pit lake, grassland areas and if applicable areas of increased woody vegetation. These points will	Environmental department	Annual walk down of all banks along the pit lake. Sherman trapping should be done on an annual basis to monitor small mammal diversity. Camera trap surveys should be conducted on a bi-annual basis, a winter

<table>
<tr><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td>be designed to accurately monitor the following parameters:
o Species diversity (mammal, invertebrate, amphibian, reptile and avifaunal);
o Species abundance;
o Faunal community structure including species composition and diversity, which can be compared to year on year results in order to assess trend; and
o All spoor, scat and signs of faunal species occurrence must be identified and recorded.
• The following criteria will be used with regards to the avifaunal monitoring:
o Fixed and random points for bird counts to determine species composition and diversity trends. At these points, the observer must record all avifaunal species and total of species observed at the point. A Bird Laser app that can be downloaded onto a smartphone can assist with record keeping, all necessary information can be captured;
o Proposed avifaunal fixed-point monitoring must be monitored bi-annually (July and February) in order to record summer as well as winter avifaunal species utilising the focus area; and
• The method of monitoring will be designed to be objective and repeatable in order to ensure consistent results.</td><td></td><td>and a summer trapping survey, for medium to large mammals, as well as cryptic and nocturnal species.

Faunal monitoring will take place on an annually for a minimum of 10 years.</td></tr>
<tr><td>• Waste rock dumps remaining on surface</td><td>Air pollution</td><td>Post closure dust monitoring will comprise the following:
• Five direction dust fallout buckets;
• Four single dust buckets
• Two PM10 ambient concentration monitoring station.

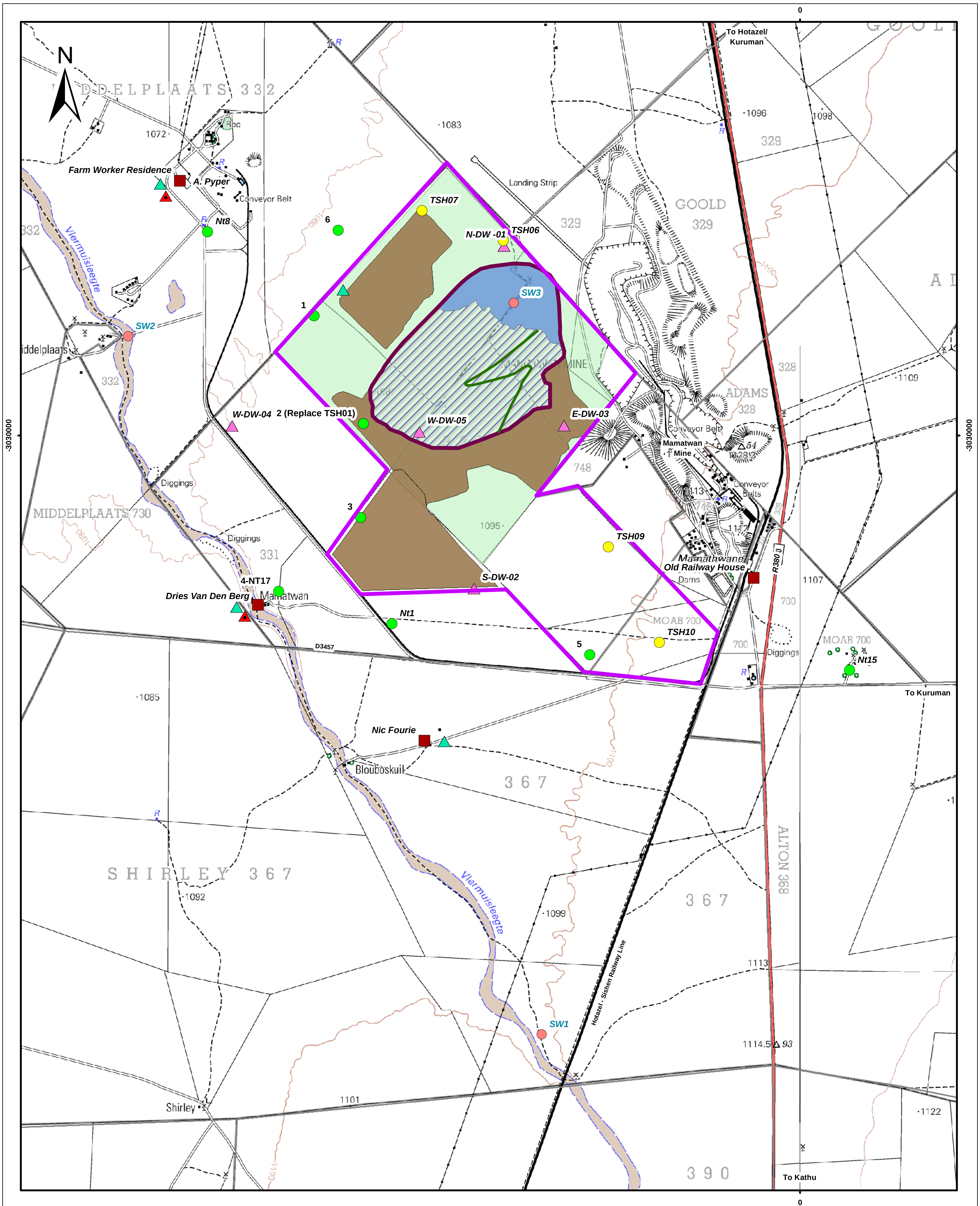
The location of the dust fallout buckets is illustrated Figure 17 and the co-ordinates are provided below.
<table>
<tr><th>Sampling point ID</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>N-DW -01 – Directional</td><td>27° 21' 49.08" S</td><td>22° 58' 2.00" E</td></tr>
<tr><td>S-DW-02 – Directional</td><td>27° 23' 51.04" S</td><td>22° 57' 49.98" E</td></tr>
<tr><td>E-DW-03 – Directional</td><td>27° 22' 53.00" S</td><td>22° 58' 25.90" E</td></tr>
<tr><td>W-DW-04 – Directional</td><td>27° 22' 53.05" S</td><td>22° 56' 13.57" E</td></tr>
</table></td><td>Environmental Department</td><td>Monitoring reports will be uploaded onto the National Emissions Inventory System on annual basis.

Dust fallout monitoring will be undertaken on a monthly basis for a minimum of 10 years.</td></tr>
</table>

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions

C-DW-05 – Directional	27° 22' 55.22" S	22° 57' 28.18" E
Dust bucket (single dust bucket)	27° 22' 4.66" S	22° 56' 57.85" E
Dust Fallout (single dust bucket)	27° 21' 26.92" S	22° 55' 45.00" E
Dust Fallout (single dust bucket)	27° 23' 57.54" S	22° 56' 15.34" E
Dust Fallout (single dust bucket)	27° 24' 45.37" S	22° 57' 38.15" E
PM10	27° 21' 31.20" S	22° 55' 47.15" E
PM10	27° 24' 0.75" S	22° 56' 18.55" E

Dust fallout monitoring will use the ASTM D1739 (1970) method as required, by the South African National Dust Control Regulations (NDCR), with regard to the dustfall unit design, dust collection and analysis.



Legend

- Tshipi Surface Use Area
- Tshipi Mining Right Area
- Access Road
- Open Pit
- Concurrent In-Pit Dumping
- Waste Rock Dumps
- Pit lake

Monitoring

- Surface Water

Air Quality Sampling Points

- Directional
- PM10
- Single

Groundwater Quality Monitoring Points

- Background Monitoring
- Plume Monitoring
- Third Party Ground Water Users

0 500 1 000 Meters

Scale: 1:38 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 17

Monitoring Programme

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

710.20008.00069

2019/07/31

28.2 PRE-CLOSURE MONITORING, AUDITING AND REPORTING

The environmental department or a suitably qualified and experienced independent specialist appointed by the owners 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 EMP report and the adequacy of the EMP report relative to the on-site activities will be assessed in the performance assessment.

A monitoring schedule has already been established at the Tshipi Borwa Mine and includes a groundwater and dust monitoring programme. Additional monitoring programmes (e.g. trials for revegetation of disturbed areas) should also be established during the ongoing operations of the mine. Monitoring is the responsibility of the environmental personnel, and is carried out by the environmental officers, who report to the environmental manager.

The closure plan, environmental risk assessment and annual rehabilitation plan will be reviewed (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. The review and update of the closure plan, environmental risk assessment and annual rehabilitation plan will be carried out by external and independent environmental consultants.

Financial provision for closure at LOM, as well as, unforeseen premature closure will be reviewed and 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 closure plan, environmental risk assessment, annual rehabilitation plan and financial provision will undergo a scientific and engineering audit (i.e. peer review) in accordance with the proposed *Financial Provisioning Regulations, 2019* (Government Gazette 42464, 2019). The financial provision amount will also be independently audited as part of any financial audit (in terms of the Companies Act, 2008).

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.

29 ENVIRONMENTAL AWARENESS PLAN

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

This section includes an environmental awareness plan for the Tshipi Borwa Mine. The plan describes how employees are informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and the training required for general environmental awareness and the dealing of emergency situations and remediation measures for such emergencies.

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

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

Environmental awareness and emergency planning applies to decommissioning phase and the initial closure phases. This will no longer be applicable when Tshipi obtains a closure certificate and/or relinquishes liability.

29.1.1 ENVIRONMENTAL POLICY

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

- Integrating environmental management into all aspects of the business, including the entire product life cycle;
- Complying with all applicable legislation and other requirement to which Tshipi subscribes;
- Practising responsible stewardship by adopting world class standards;
- Proactively identifying and managing significant environmental aspects in order to:
  - Minimising emissions to atmosphere;
  - Minimising the release of effluent;
  - Optimising resource consumption;
  - Mitigating our impacts on climate change;
  - Minimising waste;
  - Rehabilitating disturbed land; and
  - Protecting cultural heritage resources (where relevant);

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

29.1.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

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

- Management of environmental responsibilities:
  - Tshipi will establish and appoint Managers at senior mine management level at each site, who will be provided with all necessary resources to carry out the management of all environmental aspects of the site irrespective of other responsibilities, for example:
    - Compliance with environmental legislation and EMP commitments;
    - Implementing and maintaining an environmental management system with the assistance of the appointed environmental officer and SHE manager and officers;
    - Developing environmental emergency response procedures and coordinating personnel during incidents;
    - Manage routine environmental monitoring and data interpretation;
    - Environmental trouble shooting and implementation of remediation strategies; and
    - Closure planning.
- Communication of environmental issues and information:
  - Meetings, consultations and progress reviews will be carried out, and specifically Tshipi will:
    - Discussions of environmental issues and feedback on environmental projects will form part of the annual work plan of the social and ethics committee who will report periodically to the board of the company;
    - Provide progress reports on the achievement of policy objectives and level of compliance with the approved EMP to the DMR;
    - Ensure environmental issues are raised at monthly mine management executive committee meetings and all relevant mine wide meetings at all levels; and
    - Ensure environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties, where possible.
- Environmental awareness training:
  - Tshipi will provide environmental awareness training to individuals at a level of detail specific to the requirements of their job, but will generally comprise:

  - Basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site;
  - General environmental awareness training will be given to all employees and contractors as part of the Safety, Health and Environment induction programme. All non-Tshipi personnel who will be on site for more than three days must undergo the SHE induction training; and
  - Specific environmental awareness training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc.).
- Review and update the environmental topics already identified in the EMPr which currently includes the following purpose:
  - Topography (hazardous excavations);
  - Soil and land capability management (loss of soil resource);
  - Management of biodiversity;
  - Surface water management (alteration of surface drainage and pollution of surface water);
  - Groundwater management (reduction in groundwater levels/availability and groundwater contamination);
  - Management of air quality (dust generation);
  - Noise (specifically management of disturbing noise);
  - Visual aspects (reduction of negative visual impacts);
  - Surrounding land use (traffic management and land use loss);
  - Heritage resources (management of sites where needed); and
  - Socio-economic impacts (management of positive and negative impacts).
- The mine will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives; and
- Tshipi will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

29.1.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

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

- The importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- The significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;
- The individuals roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- The potential consequences of not complying with environmental procedures.

29.1.3.1 General contents of the environmental awareness plan

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

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

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

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

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

In addition to the above Tshipi will:

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

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

29.2.1 ON-GOING MONITORING AND MANAGEMENT ACTIONS

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

29.2.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Procedures to be followed in case of environmental emergencies are described in the table below (Table 29-1).

29.2.2.1 General emergency procedure

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

- An applicable incident controller defined in emergency plans must be notified of an incident upon discovery;
- An area to be cordoned off to prevent unauthorised access and tampering of evidence;
- To undertake actions defined in emergency plant to limit/contain the impact of the emergency;
- If residue facilities/dams, stormwater diversions, etc., are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Operations Engineer on shift must be notified;

- To take photographs and samples as necessary to assist in investigation;
- To report the incident immediately to the environmental department for emergencies involving environmental impacts or to the safely department in the case of injury;
- The Environment department must comply with Section 30 of the NEMA such that:
    - The Environment department must immediately notify the Director-General (DWS and DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DMR, the head of the local municipality, the head of the regional DWS office and any persons whose health may be affected of:
        - The nature of the incident;
        - Any risks posed to public health, safety and property;
        - The toxicity of the substances or by-products released by the incident; and
        - Any steps taken to avoid or minimise the effects of the incident on public health and the environment.
- The Environment department must as soon as is practical after the incident:
    - Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
    - Undertake clean up procedures;
    - Remedy the effects of the incident; and
    - Assess the immediate and long term effects of the incident (environment and public health).
- Within 14 days the Environment department must report to the Director-General DWS and DEA, the provincial head of DMR, the regional manager of the DMR, the head of the local and district municipality, the head of the regional DWS office such information as is available to enable an initial evaluation of the incident, including:
    - the nature of the incident;
    - the substances involved and an estimation of the quantity released;
    - the possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
    - initial measures taken to minimise the impacts;
    - causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
    - measures taken to avoid a recurrence of the incident.

29.2.2.2 Identification of Emergency Situations

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

29.2.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

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

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

TABLE 29-1: EMERGENCY RESPONSE PROCEDURES

ITEM	EMERGENCY SITUATION	RESPONSE IN ADDITION TO GENERAL PROCEDURES
1	Spillage of chemicals, engineering substances and waste	Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, Tshipi will: • notify residents/users downstream of the pollution incident; • identify and provide alternative resources should contamination impact adversely on the existing environment; • cut off the source if the spill is originating from a pump, pipeline or valve (e.g. refuelling bays) and the infrastructure 'made safe'; • Contain the spill (e.g. construct temporary earth bund around source such as road tanker); • pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal; and • remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	Apply the principals listed for Item 1 above. To stop spillage from the dirty water system the mine will: • redirect excess water to other dirty water facilities where possible; • pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; • carry out an emergency discharge of clean water and redirect the spillage to the emptied facility; and • apply for emergency discharge as a last resort.
3	Pollution of surface water (where relevant)	Personnel discovering the incident must inform the Environment department of the location and contaminant source. Apply the principals listed for Item 1 above. Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. Contamination entering the surface water drainage system should be redirected into the dirty water system. The Environment department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.
4	Groundwater contamination	Use the groundwater monitoring boreholes as scavenger wells to pump out the polluted groundwater for re-use in the process water circuit (hence containing the contamination and preventing further migration). Investigate the source of contamination and implement control/management actions.
5	Flooding from failure of	Evacuate the area downstream of the failure.

ITEM	EMERGENCY SITUATION	RESPONSE IN ADDITION TO GENERAL PROCEDURES
	surface water control infrastructure	Using the emergency response team, rescue/recover and medically treat any injured personnel. Temporarily reinstate/repair stormwater diversions during the storm event (e.g. emergency supply of sandbags). Close the roads affected by localised flooding or where a stormwater surge has destroyed crossings/bridges.
6	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance from emergency response team whilst attempting rescue or to carry out rescue of animals and or people as relevant. Ensure medical assistance is available to recovered individual.
7	Veld fire	Evacuate mine employees from areas at risk. Notify downwind residents and industries of the danger. Assist those in imminent danger/less-able individuals to evacuate until danger has passed. Provide emergency firefighting assistance with available trained mine personnel and equipment.
8	Falling into hazardous excavations	Personnel discovering the fallen individual or animal must mobilise the emergency response team to the location of the incident and provide a general appraisal of the situation (e.g. human or animal, conscious or unconscious, etc.). Trained professionals such as the mine emergency response team should recover the injured party. A doctor (or appropriate medical practitioner)/ambulance should be present at the scene to provide first aid and transport individual to hospital.
9	Road traffic accidents (on site)	The individual discovering the accident (be it bystander or able casualty) must raise the alarm giving the location of the incident. Able personnel at the scene should shut down vehicles where it is safe to do so. Access to the area should be restricted and access roads cleared for the emergency response team. Vehicles must be made safe first by trained professionals (e.g. crushed or overturned vehicles). Casualties will be moved to safety by trained professionals and provided with medical assistance. Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected. A nearby vet should be consulted in the case of animal injury
10	Development of informal settlements	The mine will inform the local authorities (municipality and police) that people are illegally occupying the land and ensure that action is taken within 24hrs.
11	Uncovering of graves and sites and fossils	Personnel discovering the grave or site must inform the Environment department immediately and all work must be stopped immediately The environmental department must inform the South African Heritage Recourse Agency (SAHRA) and contact

ITEM	EMERGENCY SITUATION	RESPONSE IN ADDITION TO GENERAL PROCEDURES
		an archaeologist and/or palaeontologist, depending on the nature of the find, to assess the importance and rescue them if necessary (with the relevant SAHRA permit). No work may be resumed in this area without the permission from the ECO and SAHRA. If the newly discovered heritage resource is considered significant a Phase 2 assessment may be required. Historical buildings older than 60 years fall under the jurisdiction of the Free State Provincial Heritage Authority. If any sites are affected this provincial authority should be contacted Should further burial grounds, graves or graveyards be found, the SAHRA Burial Grounds and Graves Unit must be contacted. Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local Police. The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983.

30 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

No specific information has been requested by the competent authority.

31 UNDERTAKING

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

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

Signature of EAP

Date 30/09/2019

Signature of commissioner of oath

Date 30/09/2019.

Signed this 30 day of 09/2019

ALEXANDER GROSVENOR SHORT BComm(Hons) CA(SA)
08110611
1 MACBETH AVENUE, FOURWAYS
COMMISSIONER OF OATHS
(011) 705 0000

32 REFERENCES

Airshed Planning Professionals (Pty) Ltd, Air Quality Impact Assessment for the Tshipi Borwa Manganese Mine Closure Option, June 2019.

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SLR Consulting (Africa) (Pty) Ltd, Environmental Impact Assessment and Environmental Management Programme Report for the Tshipi Borwa Mine, August 2017.

SLR Consulting (Africa) (Pty) Ltd, Environmental Impact Assessment for the Tshipi Borwa Waste Rock Dump Extension Project, April 2017.

SLR Consulting Limited, EMP Amendment No. 3 Specialist Report: Pit Closure Water Balance and Geochemical Modelling, June 2019.

SLR Consulting (Africa) (Pty) Ltd, 2019 Preliminary Closure Plan for the Alternative Closure and Rehabilitation Optimisation Project at the Tshipi Borwa Mine, June 2017a.

Terra Africa, Agriculture and Soil Impact Assessment and Management Plan for the alternative closure and rehabilitation project at the Tshipi Borwa Mine, June 2019.

APPENDIX A: EXISTING AUTHORISATIONS

- Mining right (NC/30/5/1/2/2/0206MR)
- Environmental authorisation (NC/30/5/1/2/2/206/000083 EM)
- An environmental authorisation ((NC/30/5/1/2/2/206/000130 MR)
- Water Use Licence (IWUL) (10/D41K/AGJ/1735)

APPENDIX B: EAP CURRICULUM VITAE AND REGISTRATION

- Natasha Smyth Curriculum Vitae
- Brandon Stobart Curriculum Vitae
- Brandon EAPSA certification

APPENDIX C: NEMA EA APPLICATION

APPENDIX D: STAKEHOLDER ENGAGEMENT

- DMR pre-application meeting minutes (02 May 2019);
- Correspondence with the land claims commissioner;
- Background Information Document (BID) and proof of distribution;
- Copy of site notice including photographic record and map illustrating the location of the site notices;
- Advertisements placed in the Kalahari Bulletin and the Kathu Gazette;
- Minutes of focussed meeting with DWS held on 21 June 2019;
- Minutes of public meeting held on 26 June 2019; and
- Minutes of focussed meeting with DAFF held on 27 June 2019.
- Database
- DMR acknowledgement letter of application
- BAR summary document (English and Afrikaans)
- Proof of distribution of the BAR to I&APs and commenting authorities
- Record of comments received

APPENDIX E: DETAILED ASSESSMENT OF POTENTIAL IMPACTS

Potential biophysical and socio-economic impacts were identified by SLR, specialists and stakeholders. The impacts are discussed under issue headings in this section. Due to the nature of the proposed project, the impact discussion below considers the decommissioning and closure phases of the project. It should be further noted, that cumulative impacts and latent impacts are discussed where relevant. The criteria used to rate each impact is outlined in Section 7.6.

The potential impacts are rated with the assumption that no management actions (which assume that no consideration is given to the prevention or reduction of environmental and social impacts) are applied and then again with management actions which is the mitigated scenario and represents the residual impact. In addition to this, the section below also provides a discussion on the impact significance of the proposed project within the context of the approved closure commitments (SLR, August 2017 and April 2019). A summary of the impact assessment is provided in Section 9 of the main report.

Management actions identified to prevent, reduce, control or remedy the assessed impacts are provided under the relevant impact discussions sections below. A summary of the management actions is provided in Section 26 of this report. It is important to note that management actions will include any measures outlined in the approved EMPr (SLR, August 2017) and any additional management actions identified as part of the project, where relevant. Any additional management actions will be indicated in *italics.*

GEOLOGY (MINERAL RESOURCES)

ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCES

Information in this section was sourced from the project team.

INTRODUCTION

The approved EMPr's (SLR, August 2017 and April 2019), commits Tshipi to completely backfilling the open pit at closure and as such will sterilise a deeper mineral resource located to the north of the current approved open pit. With a change to the backfill commitment the proposed project would provide for optimal future access to this resource.

The potential economic value to the national, local and regional economy through the exploitation of minerals is discussed under the economic impact section.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Post closure infrastructure associated with the impact includes:

- Partially open pit (result of in-pit dumping); and
- Raw (un-rehabilitated) waste rock dumps remaining on surface until mining ceases.

RATING OF IMPACT

Severity/ nature

In the current approved scenario where the pit is completely backfilled, the deeper manganese resource would be sterilised because of the necessity (and associated cost) of establishment of a vertical shaft complex to access the resource that could otherwise be accessed from the high wall of the open pit. This issue is relevant to whoever in future applies to mine the underground resource.

The severity of sterilising mineral resources is considered to be high because of the associated potential economic value that is lost to mineral right holder, employees, contractors, service providers and the local, regional and national economy, when sterilisation occurs.

In the unmitigated scenario of the proposed project (ie. with concurrent backfilling only), access to the underground resource becomes complex i.e. without proper planning high-wall access could be complicated and potentially hazardous. In the mitigated scenario i.e. with planning, future access to the deeper (underground) resource will be less complex, quicker and safer.

After backfilling access to selected waste rock resources will be difficult or not possible while in the scenario of the proposed project (concurrent backfill only) there is more opportunity to access to selected backfill for crushing, screening and sale as building material.
This is a low positive severity.

Duration

In the unmitigated scenario, the sub optimal access impact will rate as high as it will at least delay the project – an engineering solution will be required for the complicated and hazardous situation while in the mitigated scenario, there will be optimal access which reduces the duration to low.

Spatial scale / extent

The spatial extent of the physical impact is linked to the spatial extent of the mining area. This is a localised spatial extent as the impact remains within the mining area. If one however considers the economic nature of the impact, it will extend beyond the mining area into the broader local, regional and national economy. It follows that the spatial scale of the impact is high in both the unmitigated and mitigated scenarios.

Consequence

The unmitigated consequence is medium and positive. The mitigated consequence is high and positive with management actions.

Probability

With poor planning and placement of rock into the pit, access to the underground mining resource would be complicated which will not necessarily sterilise the resource but will probably make it more complex, more hazardous and more expensive. The related probability of the positive impact would be medium. With the implementation of management actions, correct planning would optimise access to resources, which increases the probability of the positive impact to high.

Significance

The unmitigated significance of this potential impact is medium and positive. In the mitigated scenario the significance is high and positive.

No cumulative or additional latent impacts have been identified.

Unmitigated and Mitigated – summary of impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
L+	H	H	M+	M	M+
Mitigated / Residual impact					
H+	L	H	H+	H	H+

Project impact within the context of approved closure commitments

The impact associated with the loss and sterilisation of mineral resources was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, this impact related to the difficulty of accessing mine residue resources primarily associated with waste rock backfilled into the open pit during complete backfilling and to a lesser degree from remaining surface residue facilities. The significance of the impact was rated high negative in the unmitigated scenario and was reduced to low negative with mitigation. It must be noted that at the time of completing the previous assessment, the feasibility of accessing underground resources in the future had not been contemplated and was therefore not included in the previous assessment.

Summary of the impact significance rating in the context of the approved commitment

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	Medium and positive
Mitigated	Low	High and positive

MANAGEMENT OBJECTIVES

To prevent unacceptable mineral sterilisation.

MANAGEMENT ACTIONS

Implement the following management action:

- *Planning and execution of concurrent backfilling (in-pit dumping) to achieve most efficient opportunities to access the underground mineral resources in future as well as maximising safety and establishment of biodiversity habitats. This will happen during the operational phase through to the decommissioning phase.*
- *Planning and execution of waste rock dumping to maximise access to selected waste rock for crushing and screening and sale as construction material.*

TOPOGRAPHY

ISSUE: SAFETY TO THIRD PARTIES AND ANIMALS

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

INTRODUCTION

Hazardous infrastructure and excavations include all structures into or off which third parties (persons) and animals (livestock and wild animals) can fall and be harmed. The proposed project will present final rehabilitated areas that are considered hazardous (waste rock dumps) and a partially open pit with a pit lake.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes:

- Partially open pit with pit lake (result of in-pit dumping); and
- Waste rock dumps remaining on surface.

RATING OF IMPACT

Severity/ nature

In the absence of rehabilitation and mitigation measures aimed at making the land safe, the proposed project has the potential risk of injury and/or cause death to both third parties (people) and animals (livestock and wild animals) from falling off steep slopes and/or drowning (pit lake). In addition to this, the proposed project allows for the early rehabilitation of waste rock dumps that have reached final form concurrent with mining activities. It follows that this has a high severity in the unmitigated scenario, reducing to low with management actions.

Duration

Death or permanent injury is considered a long term, permanent impact in both the mitigated and unmitigated scenarios. It follows that this is a high duration in both the mitigated and unmitigated scenarios.

Spatial scale/ extent

Direct impacts associated with hazardous infrastructure and excavations are localised within the site boundary, with or without management actions and as such this is a low spatial scale. The potential indirect impacts will however extend beyond the site boundary to the communities to which the injured people and/or animals belong. It follows that this is a medium spatial scale in both the mitigated and unmitigated scenarios.

Consequence

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

Probability

In the unmitigated scenario, without rehabilitation and making the land safe, the impact probability is expected to be medium as although the site would present potential risks, the site is remote and not close to any significant communities and the occurrence for such incidents are considered to be isolated. With management actions that focus on the rehabilitation of the waste rock dumps and making the open pit safe, the probability of the impact occurring reduces to low.

Significance

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

No cumulative or additional latent impacts have been identified.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
H	H	M	H	M	H
Mitigated/Residual impact					
L	H	M	M	L	L

Project impact within the context of approved closure commitments

The impact associated with the safety to third parties and animals was assessed as part of the approved EMPr (SLR, August 2017). In this regard, final rehabilitated land forms such as residual waste rock dumps (material that could not be backfilled into the open pit due to the bulking factor) would remain in perpetuity. The significance of the impact was rated high in the unmitigated scenario and was reduced to low with mitigation. With reference to the discussion above, the proposed project does not alter the approved EMPr significance rating.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	High
Mitigated	Low	Low

MANAGEMENT OBJECTIVES

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

MANAGEMENT ACTIONS

Implement the following management actions:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr (SLR, August 2017 and April 2019). These management actions focus on rehabilitation and limiting the footprint of disturbance;

- At closure *all potentially hazardous surface infrastructure except the waste rock dumps and pit* will have been removed. This will happen at the end of the operations phase and in the decommissioning phase;
- *Waste rock dumps will be* rehabilitated in a manner that it does not present a long term safety and/or stability risk. *In addition to this, planning and execution of waste rock dumping to maximise opportunity for rehabilitation concurrent with mining must be implemented.* This will commence in the operations phase and will continue through to the closure phase;
- *Tshipi will ensure that the partially open pit will be made and kept safe. This will commence in the operations phase and will continue through to the closure phase. Actions include:*
  - *Ensuring that the final pit slopes design maintains long term stability performance;*
  - *The top bench slope of the pit (i.e. to roughly 10m below natural ground level to (1V:3H) is maintained and where possible a lesser gradient. Sloped area must be top soiled and re-vegetated;*
  - *The 2m high exclusion berm around the high wall side of the pit is constructed and maintained;*
  - *Fencing and warning signs with images and appropriate languages located along the high wall berm to prevent inadvertent access; and*
  - *Access to the pit lake will only be via the converted haul-ramp that will be constructed to ensure the safety of third parties and animals.*
- In case of incident or death due to hazardous excavations and infrastructure, the emergency response procedure in Section 29.2.2.1 will be followed.

SOIL AND LAND CAPABILITY

ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

Information in this section was sourced from the approved EMPr (SLR, June 2019) and the soil and land capability study undertaken for the proposed project included in Appendix F.

INTRODUCTION

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

There are a number of activities that have the potential to pollute soil resources, particularly in the unmitigated scenario. In the decommissioning phase these activities are temporary in nature. Although these activities are temporary, the potential loss of soil as an ecological driver is long term. The closure phase will also present final land forms such as the waste rock dumps that may have the potential to contaminate soil through long term run-off.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes waste rock dumps remaining on surface.

RATING OF IMPACT

Severity/ nature

The decommissioning and closure phases present numerous sources of soil pollutants that can result in a loss of soils and associated land capability as a resource. This in turn can result in a loss of soils as an ecological driver because it can create a toxic environment for vegetation and ecosystems that rely on the soil. In the unmitigated scenario, decommissioning phase pollution sources include spillages of waste material, dirty water, fuel, lubricants and leaks from vehicles and equipment and run-off from waste rock dumps. In the unmitigated scenario, potential closure phase pollution sources include run-off from waste rock dumps.

This is a high severity in the unmitigated scenario. In the mitigated scenario, where decommissioning activities are controlled according to the existing approved EMPr and the closure plan is implemented effectively, the severity reduces to low.

Duration

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

Spatial scale/extent

In the unmitigated scenario, the potential loss of soil resources and associated land capability will extend beyond the site boundary. This is a medium spatial scale. With management actions, the potential loss of soil resources and associated land capabilities will be restricted to within the site boundary. This is a low spatial scale.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario with management actions the consequence is low.

Probability

Without any management actions the probability of impacting on soils and land capability through pollution events is definite. This is a high probability. With management actions, the probability reduces to low because during the decommissioning phase, emphasis is placed on preventing pollution events and on quick and effective remediation and during the closure phase emphasis is placed on effectively implementing the closure plan. It follows that the probability reduces to low.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance is low.

No cumulative or additional latent impacts have been identified.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
H	H	M	H	H	H
Mitigated/Residual impact					
L	L	L	L	L	L

Project impact within the context of approved closure commitments

The impact associated with loss of soil and land capability through contamination was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, the significance of the impact was rated high in the unmitigated scenario and reduced to low with mitigation. The proposed project does not alter the impact rating.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	High
Mitigated	Low	Low

MANAGEMENT OBJECTIVE

The objective is to minimise the loss of soil resources and related land capability through contamination.

MANAGEMENT ACTIONS

Implement the following management actions:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on pollution prevention through the implementation of waste management procedures for the storage, handling and disposal of general and hazardous waste;
- During Closure, specifications for post rehabilitation auditing will be determined and implemented to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures; and
- In case of major spillage incidents the emergency response procedure in Section 29.2.2 will be followed.

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

Information in this section was sourced from the approved EMPr (SLR, June 2019) and the soil and land capability study undertaken for the proposed project included in Appendix F.

INTRODUCTION

Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. There are a number of activities/infrastructure that have the potential to disturb soils and related land capability through removal, compaction and/or erosion, particularly in the unmitigated scenario. The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. This section focuses on the potential for physical disturbance of the soil resources and the effect this has on land capability.

In the decommissioning phases these activities could be temporary in nature. Although the activities are temporary the loss of soil for the use of re-establishing post closure land capability is long term. The closure phase will present final land forms such as waste rock dumps remaining on surface that may be susceptible to erosion.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes waste rock dumps remaining on surface.

RATING OF IMPACT

Severity/ nature

In the unmitigated scenario, physical soil disturbance can result in a loss of soil functionality as an ecological driver. In the case of erosion, the soils will be lost to the area of disturbance. In the case of compaction, the soils functionality will firstly be compromised through a lack of rooting ability and aeration, and secondly the compacted soils are likely to erode because with less inherent functionality there will be little chance for the establishment of vegetation and other matters that naturally protects the soils from erosion. This is a high severity in the unmitigated scenario. In the mitigated scenario, where decommissioning activities are controlled according to the existing EMPr and the closure plan is effectively implemented to support post closure land capability the severity reduces to low.

Duration

In the unmitigated scenario the loss of soil and related land capability is long term and will continue after the life of the mine. This is a high duration. In the mitigated scenario, most of the soil is conserved and used for rehabilitation which reduces the duration of the impact to the life of the operations. This is a medium duration.

Spatial scale/extent

In both the unmitigated and mitigated scenarios, the potential loss of soil and land capability through physical disturbance will be restricted to within the site boundary. This is a low spatial scale.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario with management actions the consequence is low.

Probability

Without any management actions the probability of losing soil and related land capability is definite. This is a high probability. With management actions, the probability reduces to low because during the decommissioning phase, emphasis will be placed on soil conservation and re-use during rehabilitation and during the closure phase emphasis is placed on effectively implementing the closure plan. It follows that the probability reduces to low.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance is low.

No cumulative or additional latent impacts have been identified.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
H	H	L	H	H	H
Mitigated/Residual impact					
L	M	L	L	L	L

Project impact within the context of approved closure commitments

The impact associated with loss of soil and land capability through contamination and physical disturbance was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, the significance of the impact was rated high in the unmitigated scenario and reduced to low with mitigation. The proposed project does not alter the impact rating.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	High
Mitigated	Low	Low

MANAGEMENT OBJECTIVE

The objective is to minimise the loss of soil resources and related land capability through physical disturbance.

MANAGEMENT ACTIONS

Implement the following management actions:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on implementing the soil conservation procedure (stripping, stockpiling, erosion control and stockpile management), rehabilitation and limiting the area of disturbance to what is necessary;
- Rehabilitation will be undertaken in line with an approved mine closure plan that ensures a suitable post-closure land use is achieved. This will happen during the decommissioning phase;
- As part of closure planning, the designs of any permanent landforms (waste rock dumps) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring. This will happen during the decommissioning phase; and
- *Post closure erosion monitoring and aftercare until no longer deemed necessary.*

BIODIVERSITY

ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Information in this section was sourced from the approved EMPr's (SLR, August 2017 and SLR, April 2019) and the biodiversity study compiled for the proposed project (SAS, May 2019) included in Appendix G.

INTRODUCTION

There are a number of activities/infrastructure that have the potential to destroy biodiversity in the broadest sense. In this regard, the discussion relates to the physical destruction of habitat and related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem.

MINE PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure including open pit void (result of in-pit dumping) and Waste rock dumps remaining on surface.

RATING OF IMPACT

Severity/nature

Areas of high ecological sensitivity are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host protected species (Grey Camel Thorn and Camel Thorn). The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas which is a key function for the broader ecosystem. The transformation of land for any purpose, including mining and associated activities, increases the destruction of the site specific biodiversity, the fragmentation of habitats, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between different areas of biodiversity importance.

In the unmitigated scenario, where rehabilitation has not been implemented effectively during the decommissioning phase, the closure phase will be presented with the following scenario:

- Exposed and un-revegetated areas that were cleared during the construction and operation of the mine that will be unable to support a functioning biodiversity habitat at closure;
- Waste rock dumps that have not been sloped and capped with topsoil to allow for revegetation; and
- An open pit void that has not been profiled correctly and therefore will not support the creation of habitats around the pit lake.

Taking the above into consideration, this is a high severity in the unmitigated scenario. In the mitigated scenario, where decommissioning activities are controlled according to the EMPr and the pit lake design principles for the creation of the aquatic environment as outlined in Section 3.2.6 and the topography and topsoil reinstatement plan and re-vegetation plan has been implemented as outlined in Sections 3.2.7.1 and 3.2.7.2 respectively, the severity of the impact is high and positive.

Duration

In the unmitigated scenario the loss of biodiversity and related functionality is long term and will continue after the life of the mine. This is a high duration. With effective rehabilitation and revegetation, the terrestrial and aquatic habitats will support biodiversity and related functional well beyond closure. This is also a high (positive) duration in the mitigated scenario.

Spatial scale / extent

Given that biodiversity processes are not confined to the mine site, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenarios. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

Consequence

In the unmitigated scenario the consequence is high negative. In the mitigated scenario with management actions, the consequences changes to a high positive.

Probability

Without management actions the probability is definite. With management actions, it is possible that biodiversity and related functionality will be restored with management actions. This is a medium probability.

Significance

The significance of this potential impact in the unmitigated scenario is high. In the mitigated scenario the significance changes to a high positive.

No cumulative or additional latent impacts have been identified.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
H	H	M	H	H	H
Mitigated/Residual impact					
H+	H	M	H+	M	H+

Project impact within the context of approved closure commitments

The impact associated with the physical destruction of biodiversity was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, the significance of the impact was rated high in the unmitigated scenario and reduced to medium with mitigation. The proposed project does not alter the significance rating in the unmitigated scenario. With mitigation the significance rating changes to a high positive with a change to the closure commitment because with access to a functional pit lake, aquatic habitats can be created and terrestrial habitats can be enhanced.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	High
Mitigated	Medium	High and positive

MANAGEMENT OBJECTIVE

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

MANAGEMENT ACTIONS

Implement the following management action plan:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on:
  - Implementing the biodiversity action plan;
  - Limiting vegetation clearing;
  - Re-vegetation of disturbed areas no longer in use;
  - Monitoring of protected trees;
  - Obtaining permits for the removal of protected trees and/or plants; and
  - Implement a biodiversity offset if requested by DAFF.
- *To ensure a sustainable aquatic system which supports biodiversity and ecology of the area, suitable habitats will be created within the pit-lake. This will happen in the decommissioning phase through to the closure phase. Design and management as detailed in Section 3.2.6 include:*
  - *The creation of shallows;*
  - *The creation of gravel beds and scree slopes;*

  - *The introduction of aquatic vegetation;*
  - *The introduction of desirable fish species; and*
  - *The construction of floating wetlands.*
- *Ensure that the design criteria and methods to enhance support of post closure terrestrial ecology as outlined in Section 3.2.7 is implemented. This will happen during the decommissioning phase through to the closure phase. Design and management criteria as detailed in Section 3.2.7 includes:*
  - *Implementing the topography and topsoil plan outlined in Section 3.2.7.1 which focusses on:*
    - *Ripping of hardened surfaces;*
    - *Replacement of topsoil and appropriate soil depth to promote vegetation growth;*
    - *Sloping and netting of waste rock dumps to promote revegetation; and*
    - *Ensuring final closure plans and designs do not prohibit movement of species.*
  - *Implement the revegetation plan outlined in Section 3.2.7.2 which focusses on:*
    - *Re-vegetation using trees and shrubs endemic to the area;*
    - *Collective seeding;*
    - *The use of seed mixes;*
    - *Reseeding timing; and*
    - *Control of alien and invasive species.*
- *A suitably qualified aquatic ecologist will be consulted during the design of the aquatic and terrestrial habitats. This will happen during the decommissioning phase through to the closure phase; and*
- *Conduct post closure biodiversity monitoring as outlined in Section 28 during the closure phase until it is no longer deemed necessary.*

ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the approved EMPr's (SLR, August 2017 and SLR, April 2019) and the biodiversity study compiled for the proposed project (SAS, May 2019) included in Appendix G.

INTRODUCTION

There are a number of activities/infrastructure that has the potential to directly disturb vegetation, vertebrates and invertebrates particularly in the unmitigated scenario. In the decommissioning phase these activities are temporary in nature. Although these activities are temporary in nature, the associated disturbance can be long term. The closure phase will present final land forms (waste rock dumps remaining on surface) that may have pollution potential through long term run-off.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes waste rock dumps remaining on surface and pit void (result of in-pit dumping).

RATING OF IMPACT

Severity/nature

In the unmitigated scenario, where rehabilitation has not been implemented effectively during the decommissioning phase, the closure phase may be presented with the following scenario:

- Exposed areas, such as un-rehabilitated waste rock dumps, that generate excessive dust fallout that may have adverse effects on the growth of some vegetation, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation;
- Contaminated soil and contaminated run-off from un-rehabilitated waste rock dumps that may have adverse effects on the growth of some vegetation which in turn effects the success of rehabilitation;
- Multiple decommissioning phase disturbance sources that may directly impact on the survival of individual plants, vertebrates and invertebrates include:
  - Lighting can attract large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances;
  - People may kill various types of species for food and for sport;
  - Collection of firewood;
  - Veld fires;
  - People may illegally collect and remove vegetation, vertebrate and invertebrate species;
  - Noise and vibration pollution (from vehicle movement, materials handling, etc.) may scare off vertebrates and invertebrates. In some instances the animals may be deterred from passing close to noisy activities which can effectively block some of their migration paths. In other instances, vertebrates and invertebrates that rely on vibration and noise senses to locate for, and hunt, prey may be forced to leave the vicinity of noisy, vibrating activities;
  - The presence of vehicles in the area can cause road kills especially if drivers speed; and
  - General litter.
- Alien invasive species that will present an undesirable plant community at closure that will result in a low faunal species abundance and diversity, and failure of the rehabilitation objectives in terms of recreating viable habitat similar to that of pre-mining; and
- An un-profiled pit that prohibits species movement and access, particularly to the pit lake.

The closure phase may also present contaminated water within the pit lake, that if consumed may be harmful to vertebrates and invertebrates.

In addition to the above, and with reference to section 7.4.1.5, Aquifer Dependent Ecosystems (ADEs) provide habitats for an array of species, especially in arid areas, and are considered important in ecological processes and making available resources for the biodiversity in an area that would otherwise not be available. It is possible that species associated with deep root systems such as the Grey Camel Thorn (*Vachellia haematoxylon)*, and Camel Thorn (*Vachellia karroo)*, source water from groundwater aquifers. A mine related drop in groundwater levels, through dewatering of the open pit, can effectively place these trees in a situation where they are unable to reach water, particularly with larger trees as they are less adaptable to a change in groundwater levels than smaller trees. Although very limited information is known regarding how ADE plants access water and at what depths, lowering of groundwater levels may indirectly result in a loss of trees. Once dewatering has stopped, the groundwater levels will start to rebound and deep rooted trees will at some point be able to reach water. It is however an unknown how the future groundwater quality will influence the growth of these trees.

Taking the above into consideration, the severity is rated high in the unmitigated scenario. In the mitigated scenario decommissioning activities are controlled. In addition to this, with successful rehabilitation and revegetation, a suitable aquatic habitat (inclusive of suitable water quality within the pit lake) and terrestrial habitat will be created. This will promote the natural relocation of faunal species and reintroduction of floral species into the area, thereby restoring and enhancing biodiversity complexity, diversity, community sensitivity and overall community stability. This is a high positive severity in the mitigated scenario. However, given the uncertainty around ADE systems and the success of their reintroduction to the area once groundwater levels rebound, the severity of this impact has been reduced to a medium positive as a precautionary approach.

Duration

In the unmitigated scenario, without rehabilitation, the impact is long term and will extend post closure. This is a high duration. In the mitigated scenario, the natural relocation of faunal species and the reintroduction of floral species is long term; however this has been reduced to a medium duration as a precautionary approach around the uncertainty of ADE systems.

Spatial scale / extent

Given that biodiversity processes are not confined to the project site, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenarios. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario with management actions the consequence is medium and positive.

Probability

Without any management actions, the probability of negatively impacting on biodiversity through multiple disturbance events is high. In the mitigated scenario, with the successful creation of aquatic and terrestrial habitats, restoration and enhancing biodiversity complexity, diversity, community sensitivity and overall community stability is possible. This is a medium probability.

Significance

The significance of this potential impact in the unmitigated scenario is high and negative. With mitigation the significance of the impact rating changes to a medium positive.

No cumulative or additional latent impacts have been identified.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
H	H	M	H	H	H
Mitigated/Residual impact					
M+	M	M	M+	M	M+

Project impact within the context of approved closure commitments

The impact associated with the general disturbance of biodiversity was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, the significance of the impact was rated high in the unmitigated scenario and reduces to medium with mitigation. In terms of the proposed project, with access to a functional pit lake, suitable aquatic and terrestrial habitats can be created and enhanced that in turn will encourage the natural relocation of faunal species and reintroduction of floral species into the area. This changes the significant of the mitigated approved impact rating to a positive medium.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	High
Mitigated	Medium	Medium and positive

MANAGEMENT OBJECTIVE

The objective is to prevent the unacceptable disturbance of biodiversity and related ecosystem functionality.

MANAGEMENT ACTIONS

Implement the following management action plan:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on rehabilitation, implementing the alien and invasive species programme, zero tolerance killing policy, veld fire prevention; speed control, maintenance of noise equipment, dust control and pollution prevention; and
- *Conduct post closure biodiversity monitoring as outlined in Section 28. This will happen during the closure phase. In terms of the deep rooted plants such as the Camel Thorn and Grey Camel thorn, should monitoring results indicated that the growth of the trees within the pollution plume is compromised, the re-vegetation plan needs to be adjusted, where necessary.*

SURFACE WATER

ISSUES: ALTERATION OF NATURAL DRAINAGE PATTERNS

Information in this section was sourced from the approved EMPr's (SLR, August 2017 and April 2019) and the pit lake study compiled for the proposed project (SLR, June 2019) included in Appendix H.

INTRODUCTION

During the closure phase, stormwater management infrastructure to contain dirty water as required by legislation will be required around the perimeter of the waste rock dumps. In this regard the collection of rainfall and runoff will be via toe paddocks. The toe paddocks will remain until such time as the waste rock dumps have been rehabilitated successfully, after which they can be removed. Further to this, natural surface water run-off and rainfall will also be collected in the partially open pit. The collected rain-fall and run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns in a similar manner to what is currently occurring on site and will perpetuate during the decommissioning phase.

All decommissioning and post closure activities and infrastructure will be located within the Tshipi Borwa Mine area and as such will not result in the physical alteration of any nearby water resources such as the ephemeral Vlermuisleegte and Witleegte Rivers.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Key decommissioning and post closure infrastructure associated with the impact includes:

- Partially open pit (result of in-pit dumping); and
- Waste rock dumps remaining on surface.

RATING OF IMPACT

Severity/ nature

Rainfall and surface water run-off will be collected in all areas that have been designed with water containment infrastructure and through collection into the partially open pit. The collected rainfall and run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. The total MAR for the quaternary catchment D41K is 6.53 million cubic meters (mcm) (Section 7.4.1.6). The proposed project will result in a loss to the quaternary catchment by less than one percent (<1%). In the unmitigated scenario the severity is medium to low because although the reduction is measurable, it will remain in the current range. In the mitigated scenario the severity is low.

Duration

In the unmitigated scenario, the alteration of drainage patterns associated with the waste rock dumps is long term. In the mitigated scenario, the duration of the alterations is short term as the toe paddocks will be removed once vegetation has been established. This is a low duration in the mitigated scenario.

In terms of the open pit, in the unmitigated and mitigated scenarios the loss of run-off to the catchment through the collection in the partially open pit is long term. This is a high duration.

Spatial scale / extent

In the mitigated and unmitigated scenario the physical alteration of drainage patterns will extend beyond the site boundary as flow reduction impacts could extend further downstream. This is a medium spatial scale.

Consequence

In the unmitigated scenario the consequence is high to medium and low in the mitigated scenario with management actions.

Probability

The probability of the alteration of drainage patterns is definite, but the magnitude of the reduced flows is unlikely to result in substantial deterioration and related flow impacts downstream due to the relatively flat topography and high infiltration rates therefore the probability is low in both the mitigated and unmitigated scenarios.

Significance

The significance of this potential impact is medium to low in the unmitigated scenario and low in the mitigated scenario.

No cumulative or additional latent impacts have been identified.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
M-L	H	M	H-M	L	M-L
Mitigated/Residual impact					
L	H (Low for waste rock dumps)	M	M	L	L

Project impact within the context of approved closure commitments

The impact associated with the alteration of natural drainage patterns was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, the significance of the impact was rated medium in the unmitigated scenario and reduced to low with mitigation given that rehabilitation at closure will allow for the restoration of drainage patterns. In terms of the proposed project, the impact rating is similar. Although the alteration of natural drainage patterns for the partially open pit cannot be mitigated, it is important to note that the collection of rainfall and run-off in the partially open pit does contribute to the development of the pit lake which can be used for alternative uses. This is discussed in further detail in the section below.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	Medium	Medium to Low
Mitigated	Low	Low

MANAGEMENT OBJECTIVE

The objective is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.

MANAGEMENT ACTIONS

Implement the following management actions:

- *Once all infrastructure, equipment and services have been removed, the remaining surface areas will be landscaped, topsoiled and revegetated to promote natural drainage patterns. This is mainly in the decommissioning phase; and*
- *Once the waste rock dumps have been rehabilitated successfully, the toe paddocks will be removed. This will happen in both the decommissioning and closure phases.*

ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES

Information in this section was sourced from the approved EMPr's (SLR, August 2017 and April 2019), the pit lake study compiled for the proposed project (SLR, June 2019) included in Appendix H.

INTRODUCTION

There are a number of pollution sources that have the potential to pollute surface water, particularly in the unmitigated scenario. In the decommissioning phase these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. The closure phase will present final land forms such as the waste rock dumps that may have the potential to contaminate surface water through long term seepage and/or run-off.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes waste rock dumps remaining on surface and partially open pit (access to pit lake).

RATING OF IMPACT

Severity/nature

The decommissioning and closure infrastructure and activities present numerous sources of pollution that can contaminate surface water resources. In the unmitigated scenario, potential decommissioning phase pollution sources associated include:

- Sedimentation from erosion;
- Spillage of waste material, dirty water, fuel, lubricants and leaks from vehicles and equipment
- Contaminated soil areas; and
- Run-off from waste rock dumps

Potential closure phase pollution sources include:

- Contaminated pit lake water quality;

- Sedimentation from erosion; and
- Run-off from waste rock dumps.

At elevated concentrations contaminants can exceed the relevant surface water quality limits imposed by DWS and can be harmful to humans, livestock and biodiversity (Refer to the biodiversity section in this appendix for the potential biodiversity impacts. This impact will not be re-assessed in this section).

In the unmitigated scenario this is a high severity. In the mitigated scenario, where decommissioning activities are controlled according to the existing approved EMPr and the closure plan is effectively implemented, the severity reduces to low. It must be noted that this conclusion is drawn in the context of successfully achieving the stated end pit lake quality objective which is suitable for livestock watering and a functional biodiversity system but not for domestic use.

Duration

In the unmitigated scenario the sources of the contamination will extend beyond closure which is a high duration. With management actions, pollution can be prevented and/or managed and as such the impacts can be limited to the pre-closure phase. It must be noted that the pit lake water quality modelling extended to 200 years post closure.

Spatial scale / extent

In the unmitigated scenario contaminates could migrate off site, which is a medium spatial scale. In the mitigated scenario, all potential surface contamination sources will have been removed or mitigated preventing any possibility of offsite surface water contamination. This is a low spatial scale.

Consequence

In the unmitigated scenario the consequence is high and in the mitigated scenario it is low with management actions.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach surface water resources;
- Will people and livestock utilise this contaminated water; and
- Is the contamination level harmful?

The first element is that contamination reaches the surface water resources. Due to the distance of the Tshipi Borwa Mine to the closest surface water resource (Vlermuisleegte River), which is located two kilometres west of the mine, it is unlikely that pollution sources will reach surface water resources. It should also be noted that the Vlermuisleegte is ephemeral in nature and therefore is associated with long periods of no flow. In the unmitigated scenario, the pit lake will become a surface water resource that is contaminated.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. In the unmitigated scenario this is a definite possibility because one of the stated end uses is grazing and use of the pit lake for livestock watering.

The third element in the unmitigated scenario, it is that it likely that some contaminants will be at a level which is harmful to humans and livestock. In the unmitigated scenario, this is possible particularly for the pit lake.

As a combination, the unmitigated probability is high, reducing to low with management actions.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance is reduced to low.

It is however important to note that a potential latent impact could be associated with long term deterioration of pit lake water quality subject to the success of the ongoing floating wetland water treatment. If this latent impact manifests and cannot be mitigated through treatment adaptations then the use of/access to the pit lake will have to be reconsidered. The associated default management measure will be to fence and/or berm off access to the pit lake.

No cumulative impact has been identified.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
H	H	M	H	H	H
Mitigated/residual impact					
L	L	L	L	L	L

Project impact within the context of approved closure commitments

The impact associated with the contamination of surface water resources was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, the significance of the impact was rated medium in the unmitigated scenario and reduced to low with mitigation. It is however important to note that the assessment focussed on the contamination of the Vlermuisleegte River only. The proposed project introduces issues associated with the pit lake which changes the assessment, particularly in the unmitigated scenario.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	Medium	High
Mitigated	Low	Low

MANAGEMENT OBJECTIVE

The objective is to prevent pollution of surface water resources.

MANAGEMENT ACTIONS

Implement the following management actions:

- In order to address various potential pollution sources associated with decommissioning activities, Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on pollution prevention (collection, storage and disposal of hazardous waste), implement the stormwater management plan, regular inspection and maintenance of water management facilities and waste rock dumps and maintenance and servicing equipment and vehicles;
- *During operations, decommissioning and the initial part of the closure phase, surface water run-off and seepage paddocks will be installed and maintained around all waste rock dumps;*
- *Tshipi will implement the topography/topsoil and revegetation plans during the decommissioning phase as outlined in Sections 3.2.7.1 and 3.2.7.2. Once rehabilitated the final land forms are unlikely to erode and/or contribute to pollution run-off. Once this is confirmed, the run-off containment toe paddocks around the waste rock dumps can be removed and rehabilitated;*
- During the decommissioning phase *and the initial monitoring and aftercare part of the closure phase*, Tshipi will continue to implement a monitoring programme for surface water resources. This includes monitoring both up and downstream of the Vlermuisleegte when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme is outlined in Section 28;
- *Once mining activities cease in the pit and sufficient water is available (during the closure phase), a floating wetland system will be implemented using a combination of vegetation types and surface area coverage that will enable the treatment of the pit lake water to meet DWS livestock watering objectives. Research, references and modelling indicate that this can be a successful treatment solution, but final design, maintenance requirements and related monitoring will be determined only on the basis of implementation on site. In this regard, final closure planning will be sufficiently flexible to allow for the following:*
  - *Ongoing optimisation and improvement of the floating wetland system;*
  - *Adaptation to changing circumstances that might require implementation of alternative and/or additional treatment technologies; and*
  - *Contingency planning in the event that water treatment becomes ineffective at some point in future and access to/use of the pit lake requires reconsideration.*
- *During the closure phase, monitoring the pit lake water quality will be undertaken. Details of the surface water monitoring programme is outlined in Section 28;*
- During the decommissioning and the monitoring and aftercare part of the closure phases, should any surface water resource contamination be detected, the mine will immediately notify DWS. Tshipi, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users (eg. farmers using the water for livestock watering), identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then

implement these measures. Any related loss caused by Tshipi (in the short and long term) will be addressed through compensation, which may include an alternative water supply of equivalent quality and quantity; and

- Implement the emergency response procedure in Section 29.2.2 in the event of a potentially polluting discharge incident.

GROUNDWATER

ISSUE: LOWERING OF GROUNDWATER LEVELS

Information in this section was sourced from the approved EMPr's (SLR, August 2017 and April 2019), the pit lake study compiled for the proposed project (SLR, June 2019) included in Appendix H.

INTRODUCTION

Dewatering of the open pit during operations has the potential to lower groundwater levels. Lowering of groundwater levels through dewatering may cause a loss in water supply to surrounding borehole users if they are in the impact zone. Once dewatering activities cease, groundwater levels will start to rebound.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Activities associated with this impact include the cessation of dewatering.

DISCUSSION

Prior to mining the natural depth of the water in surrounding boreholes ranged from 25 to 55 m below ground level. Groundwater level monitoring data currently shows water depths ranging from 41 to 75 m below ground level. At decommissioning, although dewatering activities will cease, the modelled cone of drawdown developed due to dewatering is predicted to be at a maximum extent of 5.5 km to the east and 8.3 km to the west of the Tshipi Borwa Mine. Third parties within the simulated cone of depression may therefore experience a drop in water levels. When mining and dewatering cease, groundwater levels will start to rebound and the water level in the pit will increase. Initially, inflows will be high, because the hydraulic gradient driving inflows from the aquifer into the pit would be at a maximum due to the water level being at base of the pit which will be approximately 250m below ground level. Over time, as the pit lake level rises inflows will diminish until a steady state level is reached. Due to evaporative loses and pit geometry; the partially filled pit will continue to be a hydraulic sink in perpetuity because the steady state pit lake level will remain approximately 6m below the natural groundwater level which is approximately 35 below ground level. The associated cone of depression hydraulic gradient will be significantly reduced (the depth to the base of the cone of depression reduces by 97%). It follows that groundwater levels at off-site third party boreholes are predicted to rebound to natural groundwater level. This impact has therefore not been assessed further and has been rated as being insignificant.

No additional latent impacts have been identified. If surrounding mining operations dewater it is possible that cumulative impacts on groundwater levels will be experienced.

Project impact within the context of approved closure commitments

The impact associated with the lowering of groundwater levels was not assessed at closure as part of the approved EMPr's (SLR, August 2017 and April 2019) given that it was assumed groundwater levels rebounded to natural ground level. The proposed project does not alter the impact finding.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	Insignificant	Insignificant
Mitigated	Insignificant	Insignificant

MANAGEMENT OBJECTIVE

The objective is to prevent water losses to third party water users.

MANAGEMENT ACTIONS

Implement the following management actions:

- Tshipi will continue to monitor groundwater levels (refer to Section 28 for the monitoring programme); and
- In the unlikely event that borehole users experience any additional post closure mine related water loss, Tshipi will provide compensation, which could include an alternative water supply of equivalent water quality and quantity. This will happen during the closure phase.

ISSUE: CONTAMINATION OF GROUNDWATER RESOURCES

Information in this section was sourced from the approved EMPr's (SLR, August 2017 and April 2019), the pit lake study compiled for the proposed project (SLR, June 2019) included in Appendix H.

INTRODUCTION

The closure phase will present final land forms such as waste rock dumps remaining on surface and the waste rock backfilled into the open pit that may have the potential to pollute water resources through long term seepage and/or run-off.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Post closure activities and infrastructure associated with the impact include:

- Waste rock backfilled into the open pit as part of in-pit dumping; and
- Waste rock dumps remaining on surface.

RATING OF IMPACTS

Severity/nature

Groundwater modelling undertaken for Tshipi makes provision for a worse case theoretical scenario which includes a completely backfilled open pit and all waste rock dumps remaining on surface. This allows for multiple pollution sources and re-establishment of close to normal groundwater flow. In reality, the proposed closure option will include the partially backfilled pit acting as a hydraulic sink with a draw down cone toward the pit lake in perpetuity. The reason for using the conservative theoretical modelling scenario is the precautionary principle which is relevant because of the importance of understanding groundwater risk in this particular arid region.

A chloride source concentration of 2200 mg/ℓ was simulated for the waste rock and simulated for 100 years. The worst case theoretical modelled results indicate that the pollution plume migrates off site but is unlikely to impact third party boreholes (Figure 18). When applying these conservative results to the specific context of the proposed project, the extent of the pollution plume will reduce because the partially backfilled pit will act as a hydraulic sink and associated draw down cone will draw some of the pollution plume into the pit. No impact on any off-site third party boreholes is predicted. In both the mitigated and unmitigated scenarios the severity of the impact is low.

Duration

Groundwater contamination is long term in nature, occurring post closure in both the unmitigated and mitigated scenarios. This is a high duration in the unmitigated scenario. In the mitigated scenario, the contamination source will significantly reduce once the topsoiling and revegetation of the remaining waste rock dumps is complete because rainfall infiltration through the waste rock dump into the underlying ground will significantly reduce. This is a medium duration.

Spatial scale / extent

No impact on any off-site third party boreholes is predicted. In both the mitigated and unmitigated scenarios the spatial extent is low.

Consequence

The consequence is medium in the unmitigated scenario and reduces to low with mitigation.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach groundwater resources;
- Will people and animals utilise this contaminated water; and
- Is the contamination level harmful?

The first element is that contamination reaches the groundwater resources underneath or adjacent to the site. Pollution plume modelling shows that contaminants could reach groundwater resources.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There are no known third party boreholes located within the contaminant plume.

The third element is whether contamination is at concentrations which are harmful to users. Based on groundwater modelling predictions, potential contamination will be at low concentrations for a small area outside of the Tshipi Borwa Mine area.

As a combination, the unmitigated and mitigated probability is low.

Significance

The significance of this potential impact in both the unmitigated and mitigated scenarios is low.

No additional latent impacts have been identified. Modelling includes contributions from off-site sources in the context of current water quality. The predictive modelled results are therefore cumulative in nature.

Unmitigated and Mitigated – summary of the impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
L	H	L	M	L	L
Mitigated/Residual impact					
L	M	L	L	L	L

Project impact within the context of approved closure commitments

The impact associated with the contamination of groundwater resources was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard, the significance of the impact was rated low in the mitigated and unmitigated scenarios. The proposed project does not change the significant impact ratings, however the proposed project minimises the extent of the pollution plume because of the hydraulic sink associated with the partially backfilled pit.

Summary of the impact significance rating in the context of the approved commitments

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	Low	Low
Mitigated	Low	Low

MANAGEMENT OBJECTIVE

The objective is to prevent pollution of groundwater resources and related harm to other water users.

MANAGEMENT ACTIONS

Implement the following management actions:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on implementing the stormwater management plan, pollution prevention through appropriate infrastructure design of waste rock dumps and updating the groundwater model;
- Post closure ground water monitoring will be undertaken until it is no longer deemed necessary. The post closure monitoring programme is included in Section 28; and

- If water users experience any Tshipi related contamination, Tshipi will provide compensation, which could include an alternative water supply of equivalent water quality. This commitment extends into the closure phase.

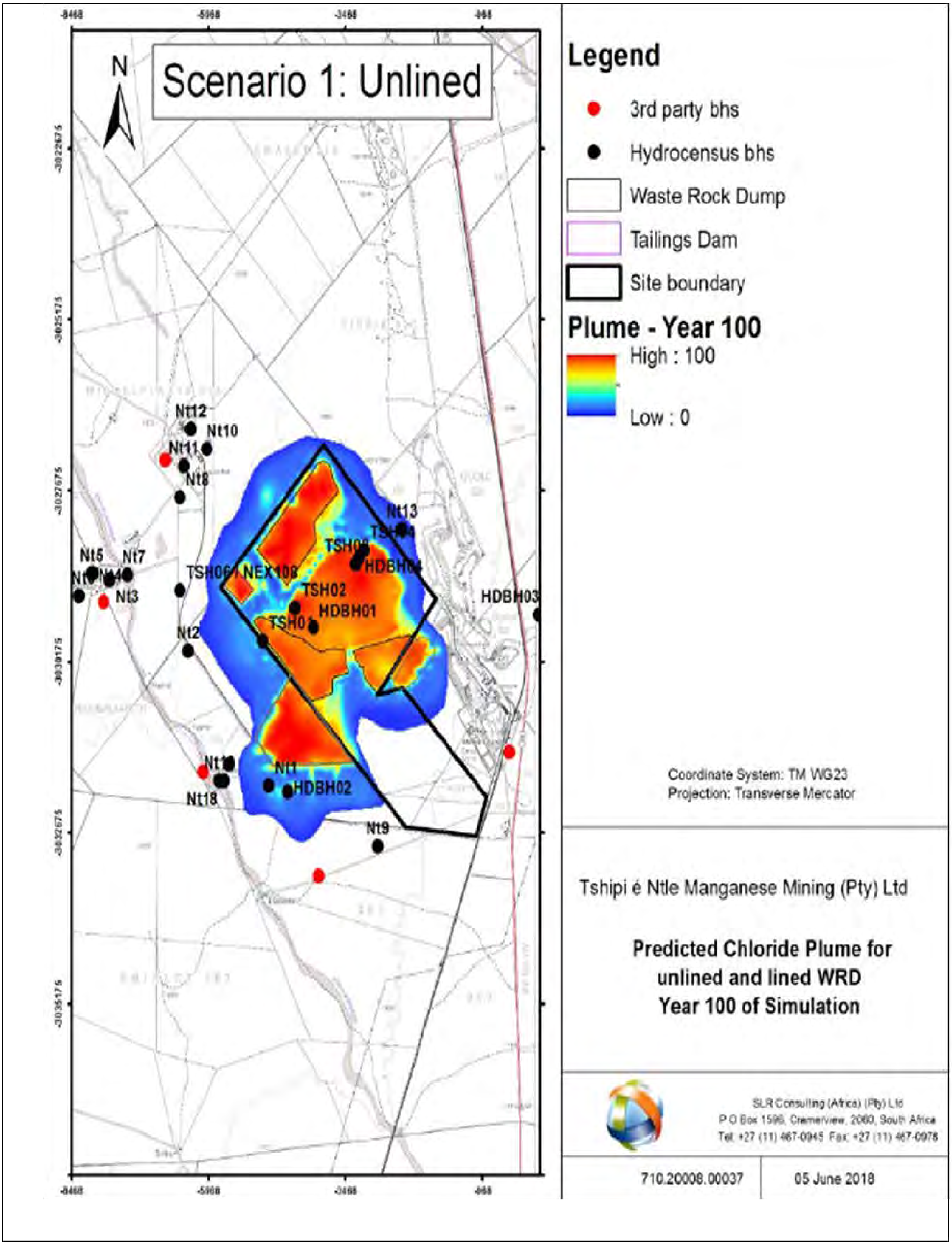


FIGURE 18: PREDICTED CHLORIDE PLUME – YEAR 100 OF SIMULATION (SLR, 2018)

AIR QUALITY

ISSUE: AIR POLLUTION

Information in this section was sourced from the approved EMPr (SLR, August 2019) and the air quality study undertaken for the proposed project (Airshed, June 2019) including in Appendix I.

INTRODUCTION

The proposed project has the potential to contribute to the pollution of air through the presence of final land forms such as the waste rock dumps remaining on surface.

Air pollution related impacts on biodiversity are discussed in the biodiversity section of this appendix and therefore this section focuses on the potential for human health impacts.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Aside from short term decommissioning activities, post closure infrastructure associated with the impact includes waste rock dumps remaining on surface.

RATING OF IMPACT

Severity/ nature

The main contaminants associated with the proposed project include: inhalable particulate matter less than 10 microns in size (PM_{10} and $PM_{2.5}$), larger total suspended particulates (TSP) that relate to dust fallout, Mn concentration (within waste rock dumps), and gaseous emissions mainly from vehicles and generators. At closure, the main source of windblown dust will be from the exposed waste rock dump surfaces. In this regard, modelled results indicate the following:

- In the unmitigated scenario, PM_{10} daily ground level concentrations due to windblown dust from the waste rock dumps is in compliance with the NAAQS off-site and will only exceeding the daily NAAQS of 75 µg/m³ on-site at the waste rock dumps. The modelled post closure annual average concentrations comply with the NAAQS of 40 µg/m³ limit on and off-site;
- In the unmitigated scenario, $PM_{2.5}$ daily ground level concentrations due to windblown dust from the waste rock dumps are low and well within compliance with the 2030 NAAQS of 25 µg/m³off-site. The only on-site exceedances of the 2030 NAAQS of 25 µg/m³ is associated at the western waste rock dump. The modelled post closure annual average concentrations comply with the 2030 NAAQS of 15 µg/m³ limit on and off-site;
- In the unmitigated scenario, the maximum daily dustfall rates are below the NDCR residential limit (600 mg/m²/day) off-site, and below the non-residential limit of 1 200 mg/m²/day on-site; and
- In the unmitigated scenario, the highest annual average Mn concentration is 0.03 µg/m³, which is well below the WHO annual average manganese guideline of 0.15 µg/m³.

Taking the above into consideration, the severity in the unmitigated scenario is low as exceedances of the PM_{10}, $PM_{2.5}$, dust fallout and Mn concentrations are unlikely to be experienced at sensitive receptors. With mitigation, the severity can be further reduced.

Duration

Health related impacts could extend beyond closure. This is a high duration. With mitigation focussed on rehabilitation, the duration of impacts will be limited to the life of the project. This is a medium spatial scale.

Spatial scale/ extent

Exceedances of the NAAQS (Mn and NDCR concentrations are will within limits) only occur within the Tshipi Borwa Mine boundary and as such the spatial scale of the potential impact is localised within the site boundary. This is a low spatial scale in both the unmitigated and mitigated scenarios.

Consequence

The unmitigated consequence is medium and reduces to low with mitigation.

Probability

The health impact probability is linked to the probability of ambient concentrations exceeding the evaluation criteria in relation to potential receptors. In the unmitigated and mitigated scenarios this is low as modelled results indicate no exceedances are expected at potential receptors.

Significance

The significance of this potential impact is low in both the unmitigated and mitigated scenarios.

No additional latent impacts have been identified. Modelling includes contributions from off-site sources in the context of current air quality. The predictive modelling results are therefore cumulative in nature.

Unmitigated and Mitigated – summary of impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
L	H	L	M	L	L
Mitigated/Residual impact					
L	M	L	L	L	L

Project impact within the context of approved closure commitments

The impact associated with air quality was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). The impact was rated high in the unmitigated scenario and reduced to medium with mitigation, but remained high for Mn concentrations even with mitigation. In the approved EMPr's (SLR, August 2017 and April 2019) it was noted, that even in the mitigated scenario Mn concentrations were predicted to exceed World Health Organisation (WHO) guidelines at a number of residence and farm houses (A.Pyer, Middelplaats and Nic Fourie). While manganese is an essential trace element that is required for good health, exposure to high levels of manganese can cause neuro-toxic health effects in susceptible individuals – generally referred to as Manganism.

It is important to note that since the approved EMPr's (SLR, August 2017 and April 2019); the Mn content concentrations within the waste rock dumps at Tshipi have been sampled, whereas previously, conservative assumptions were made around the Mn content concentrations within the dumps. For these reasons, the unmitigated and mitigated significance reduces as part of the proposed project.

Summary of the impact significance rating in the context of the approved commitment

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	Low
Mitigated	Medium (remained high for Mn concentrations)	Low

MANAGEMENT OBJECTIVES

The objective is to prevent air pollution health impacts.

MANAGEMENT ACTIONS

Implement the following management actions:

- Tshipi must implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on speed control, use of dust binding agents and/or dust suppression (roads), water sprays at loadings and conveyor points; and
- *The current monitoring programme for dust fallout and PM_{10} and $PM_{2.5}$ (Section 28) at the Tshipi Borwa Mine should be extended post closure until such time that it is not deemed necessary. This can only be determined by a qualified specialist.*

NOISE

ISSUES: INCREASE IN DISTURBING NOISE LEVELS

Information in this section was sourced from the approved EMPr (SLR, October 2017) and the noise impact study undertaken for the proposed project included in Appendix J.

INTRODUCTION

Decommissioning and post closure activities/infrastructure presents the possibility of generating both noise disturbances and noise nuisance. This section considers the change in noise impacts resulting from the change in post closure activities. Decommissioning activities are not re-assessed because these are short term in nature and have previously been assessed as insignificant in the context of ongoing operational noise as currently experienced.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Post closure activities associated with the impact include monitoring, aftercare and maintenance.

RATING OF IMPACT

Severity/ nature

Noise pollution can create nuisance that will have different impacts on different receptors because some are very sensitive to noise and others are not. Potential human noise receptors include the isolated residences and farmhouses (Section 7.4.1.9) within 2 km radius of the Tshipi Borwa Mine. Based on the prevailing wind field (Section 7.4.1.3), disturbing noise levels are expected to be more notable to the east and south during the day and to the north and north-northwest during the night. Post closure activities that may generate disturbing noise levels include intermitted vehicle and materials handling activities associated with post closure monitoring, maintenance and aftercare. Exiting operational baseline noise at the Tshipi Borwa mine is below the IFC guideline for residential areas, and as part of on-site monitoring, no audible noise from the mining operations were noted, only noise from cicadas (insects). It follows that the severity of post closure noise impacts in the unmitigated and mitigated scenarios is low.

Duration

The duration of disturbing noise levels post closure is linked to the duration of the post closure activity. It follows that the duration in both the mitigated and unmitigated scenarios is less than the project life, given the intermitted use of vehicles and material handling. This is a low duration.

Spatial scale/ extent

The noise footprint is expected to be restricted to the immediate vicinity of the activity. This is a low spatial scale in both the mitigated and unmitigated scenarios.

Consequence

In both the unmitigated and mitigated scenarios, the consequence is low.

Probability

Exiting operational baseline noise at the Tshipi Borwa mine is below the IFC guideline for residential areas. It follows that it is highly unlikely that noise impacts will impact receptors at closure. This is a low probability in both the unmitigated and mitigated scenarios.

Significance

The significance of this potential impact is low in both the unmitigated and mitigated scenarios.

No additional latent impacts have been identified. In the context of the current operational impacts no cumulative impacts have been identified.

Unmitigated and Mitigated – summary of the noise impact

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

Unmitigated					
L	L	L	L	L	L
Mitigated/Residual impact					
L	L	L	L	L	L

Project impact within the context of approved closure commitments

The impact associated with disturbing noise was not assessed as part of the approved EMPr's (SLR, August 2017 and April 2019) as noise disturbances and noise nuisance activities were limited to all phases prior to closure. The proposed project presents addition monitoring, aftercare and maintenance/adjustment requirements (creating of aquatic habitats) and as such alters the significance rating.

Summary of the impact significance rating in the context of the approved commitment

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	Not applicable	L
Mitigated	Not applicable	L

MANAGEMENT OBJECTIVES

To prevent public exposure to disturbing noise.

MANAGEMENT ACTIONS

Implement the following management actions:

- *All diesel-powered equipment and vehicles should be kept at a high level of maintenance / in a good state of repair. This should particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance;*
- *Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels;*
- *In managing noise specifically related to truck and vehicle traffic, efforts should be directed at:*
    - *Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program;*
    - *Maintain road surface regularly to avoid corrugations, potholes etc;*
    - *Avoid unnecessary idling times;*
    - *Minimising the need for trucks/equipment to reverse, through appropriate traffic management plans. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. Alternatives to the traditional reverse 'beeper' alarm such as a 'self-adjusting' or 'smart' alarm could be considered. These alarms include a mechanism to detect the local noise level and automatically adjust the output of the alarm is so that it is 5 to 10 dB above the noise level near the moving equipment. The promotional material for some smart alarms does state that the ability to adjust the level of the alarm is of advantage to those sites 'with low ambient noise level';*
    - *Limiting traffic to hours to between 06:00 and 18:00.*

- *Where possible, other non-routine noisy activities likely to occur should be limited to day-time hours;*
- A noise complaints register must be kept as relevant; and
- Investigative short term ambient noise measurements could potentially be conducted only in the highly unlikely event that post closure activities lead to material noise related complaints.

VISUAL

ISSUE: NEGATIVE VISUAL VIEWS

Information in this section was sourced from the visual study (Graham, June 2019) undertaken for the proposed project and included in Appendix K.

INTRODUCTION

Visual impacts on this receiving environment may be caused by infrastructure remaining on surface at closure. The proposed project will present final landforms (waste rock dumps and a partially open pit) which may result in long-term visual impacts.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes:

- Partially open pit (result of in-pit dumping); and
- Waste rock dumps remaining on surface.

RATING OF IMPACT

Severity/ nature

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of mine related infrastructure and activities.

As discussed in Section 7.4.1.10, the visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the visual landscape within the Tshipi Borwa Mine area has been transformed due to the presence of approved mining infrastructure and activities. In general, the visual landscape of the area surrounding the Tshipi Borwa Mine is characterised by flat open areas associated with semi-arid vegetation and an ephemeral river (Vlermuisleegte River), that has been influenced by the presence of existing mining operations, roads, powerline infrastructure and isolated farmsteads.

When considering the potential change to the visual landscape the key issues are: visual exposure, visual intrusion, and sensitivity of receptors. The proposed project will present visual intrusions (waste rock dumps remaining on surface and a partially open pit) post closure that may be perceived negatively by sensitive receptors, particularly in the unmitigated scenario were rehabilitation activities during decommissioning have not been implemented. The severity in the unmitigated scenario is rated medium given that even without rehabilitation Tshipi is located adjacent to existing mining operations (UMK and Mamatwan), which has resulted in a deteriorated the natural landscape. In the mitigated scenario, the severity reduces to low with rehabilitation.

Duration

In the unmitigated scenario the duration is high because the impacts are long term. The proposed project allows for the early/concurrent rehabilitation of waste rock dumps as part of current mining operations, thereby improving the state of rehabilitation at closure. Taking this into consideration along with the successful rehabilitation of the remainder of the site, the duration of the impact is limited to less than the project life. This is a low duration in the mitigated scenario.

Spatial scale/ extent

Visual impacts are likely to extend beyond the Tshipi Borwa Mine boundary in both the unmitigated and mitigated scenarios. This is a medium spatial scale.

Consequence

The unmitigated consequence is high. The consequence reduces to medium with management actions.

Probability

In the unmitigated scenario the probability of visual impacts occurring is definite. At closure final landforms have been rehabilitated, the probability will be reduced to low.

Significance

The significance of this potential impact is high in the unmitigated scenario and reduces to low with mitigation.

No additional latent impacts have been identified. Assessing the impacts in the context of surrounding mines provides a cumulative impact assessment perspective.

Unmitigated and Mitigated – summary of impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
M	H	M	H	H	H
Mitigated/Residual impact					
L	L	M	M	L	L

Project impact within the context of approved closure commitments

The impact associated with visual disturbance was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard the significance was rated high in the mitigated scenario and low with mitigation. The proposed project does not alter the impact rating; however the state of rehabilitation of closure will be improved in the mitigated scenario through the early rehabilitation of the waste rock dumps.

Summary of the impact significance rating in the context of the approved commitment

Management	Approved EMPr (August 2017)	Proposed project

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	High
Mitigated	Low	Low

MANAGEMENT OBJECTIVES

To limit negative visual impacts.

MANAGEMENT ACTIONS

Implement the following management actions:

- Tshipi must implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on maintenance of equipment and haul roads, appropriate equipment operation and responding to noise related complaints;
- *Tshipi will commence with the rehabilitation of the waste rock dumps during the operational phase of the mine; and*
- During closure final rehabilitated areas and facilities remaining in perpetuity will be managed through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.

TRAFFIC

ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

DISCUSSION

The proposed project will not generate additional traffic and as such project-related road disturbance and traffic safety impacts are not expected to occur. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below cover the steps to be taken in the event of a road related accident and/or disturbance.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Post closure impact includes activities associated with monitoring, aftercare and maintenance.

MANAGEMENT OBJECTIVE

The objective of is to prevent transport related accidents and/or injury to people and livestock.

MANAGEMENT ACTIONS

Management actions to be implemented in include:

- In case of a person or animal being injured by transport activities the emergency response procedure in Section 29.2.2 will be followed.

HERITAGE/CULTURAL AND PALEONTOLOGICAL RESOURCES

ISSUE: LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

DISCUSSION

No heritage resources occur at the Tshipi Borwa Mine. In addition, there is a low possibility of palaeontological resources occurring in the area (see Section 7.4.1.11 of the main report). This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below cover the steps to be taken should there be a chance find.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Post closure activities include the partially open pit (result of in-pit dumping) and waste rock dumps remaining on surface.

MANAGEMENT OBJECTIVE

To minimize the disturbance of heritage/cultural and palaeontological resources.

MANAGEMENT ACTIONS

Management actions to be implemented in include:

- During the decommissioning and closure phases, prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance, Tshipi will engage a professionally registered heritage and/or palaeontological specialist to make associated recommendations that Tshipi will comply with; and
- If there are any chance finds of heritage/ cultural or paleontological sites, Tshipi will follow the emergency response procedure (Section 29.2.2).

SOCIO-ECONOMIC

ISSUE: INWARD MIGRATION

INTRODUCTION

Mining operations tend to bring with them an expectation of employment in all phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. This section focuses on the potential for the inward migration and associated social issues.

DISCUSSION

Impacts associated with inward migration were assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). While the rehabilitation plan and closure plan will have been adjusted in order to cater for the proposed project and a change to the closure objective, the proposed project will not present any additional job opportunities as Tshipi will make use of existing contractors and workers as part of rehabilitation activities. It follows that the potential for an increased social risks is considered to be negligible for the proposed project. This impact has therefore been rated as being **INSIGNIFICANT**.

MANAGEMENT OBJECTIVE

The objective is to limit inward migration and related social impacts.

MANAGEMENT ACTION

Management actions to be implemented in include the implementation of the management measures as outlined in the approved EMPr (SLR). These management actions focus on recruitment processes, communication and health awareness training.

ISSUE: ECONOMIC IMPACT

INTRODUCTION

Mining has a positive net economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees. With a change to the backfill commitment the proposed project would provide for an extended life of mine – when the underground resource is mined, and therefore an extended economic impact.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes:

- Partially open pit (result of in-pit dumping); and
- Waste rock dumps remaining on surface.

IMPACT RATING

Severity

In the current approved scenario, the open pit is completely backfilled and the land is reinstated to that of grazing/wilderness. In this scenario the following applies:

- Completely backfilling the open pit will take place using excavators, loaders, haul-trucks and conveyors to move waste rock from the surface to the pit for a period of 25 years (using one conveyor. This reduce to 10 years using two conveyors). The initial capital investment to completely backfill the open pit amounts to R82.8 million and will result in a post life of mine operational expenditure of R1.2 billion with an employment component value of R61 million over 25 years of utilising conveyors to completely backfill. Complete backfilling the Tshipi open pit will stimulate the national, local and regional economy with an approximate amount of R1.29 billion over a period of approximately 25 years but will be paid for out of retained profits which will reduce tax revenue;
- Once the pit has been backfilled and rehabilitated, livestock grazing may be able to resume. This will yield a revenue of R1 174 554 over a period of 55 years. Completely backfilling the open pit will stimulate the local economy by an approximate amount to R2.55 million in over 55 years;
- By backfilling the pit the future access to underground resources is effectively sterilised because the cost of sinking a dedicated vertical shaft renders the underground mining un-economic; and
- When the abovementioned points are considered together, from a net economic perspective, the economy will lose an estimated value of more than R 21.4 billion on a national regional and local level.

In the scenario of the proposed project, where the pit is partially backfilled as a result of in-pit dumping the following applies:

- Additional underground resources are located to the north of the current open pit and can be accessed via the high-wall of the open pit if it is not completely backfilled. This will require a life of mine capital investment R1.5 billion and will result in a revenue boost of R21.2 billion over the first 25 years of the life of (underground) mine. Underground mining activities will able to provide 246 job opportunities to a value of R5.7 billion over the first 25 years. Therefore, the change to the closure strategy has the potential to stimulate the national, local and regional economy with an estimated value of more than R21.5 billion;
- Limited livestock grazing will be able to continue due to the presence of waste rock remaining on surface. This will yield a revenue of R290 593 over a period of 55 years. Concurrent (in-pit dumping) will stimulate the local economy by an approximate amount of R631 709 over 55 years;
- There will be a loss to the national, local and regional economy where revenue generated through backfilling the open pit using conveyors will not be realised, and the local economy stimulation from cattle grazing will be reduced; and
- When the abovementioned points are considered together, from a net economic perspective, the national, regional and local economies will gain more than R21.5 billion from the mining of underground resources when partial backfilling is considered i.e. if the resource is accessed of the pit high-wall.

In the unmitigated scenario the severity is a medium and positive because with poor planning and placement of rock into the pit access to the underground mining resource can be complicated, and access to all resources my not be achievable. With mitigation the severity is high and positive where the project team can help to optimise access to resources.

Duration

The duration is long term because it relates to future long term post closure activities and land uses.

Spatial scale/ extent

In both the mitigated and unmitigated scenarios, the spatial scale of the impact is high because it will extend far beyond the proposed project area on a regional and national scale.

Consequence

The consequence in the unmitigated and mitigated scenarios is high and positive.

Probability

In the normal course of economic activity the net positive impacts will definitely occur. This is a high probability in both the unmitigated and mitigated scenarios.

Significance

The unmitigated and mitigated scenarios is high and positive.

No additional latent impacts have been identified.

Unmitigated and Mitigated – summary of impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
M+	H	M	H+	H	H+
Mitigated/Residual impact					
H+	H	M	H+	H	H+

Project impact within the context of approved closure commitments

The impact associated with the economic impact was assessed as part of the approved EMPr's (SLR, August 2017 and April 2019). In this regard in the unmitigated and mitigated scenarios the significance rating was medium to high and positive. It must be noted that at the time of completing the previous assessment, the feasibility of accessing underground resources in the future had not been contemplated and was therefore not included in the previous assessment and as such the impact rating changes.

Summary of the impact significance rating in the context of the approved commitment

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	Did not assess the feasibility of underground resources	High positive
Mitigated		High positive

Management objective

To enhance positive economic impacts.

Management actions

Management actions to be implemented in include:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 and April 2019). These management actions focus on clear communication, recruitment and procurement processes; and
- *Planning and execution of concurrent backfilling only (in-pit dumping) to achieve most efficient opportunities to access underground mineral resources in future. This will happen during the operational phase through to the decommissioning phase.*

LAND USE

ISSUE: CHANGE IN LAND USES

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

INTRODUCTION

Mining-related activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. Land uses within and surrounding the Tshipi Borwa Mine have been influenced by current mining operations. The proposed project has the potential to change the land use at closure, particularly within the mine site.

LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Decommissioning activities and post closure infrastructure associated with the impact includes:

- Partially open pit (result of partial and in-pit dumping); and
- Waste rock dumps remaining on surface.

RATING OF IMPACT

Severity / nature

Land use within the project area includes existing mining activities and infrastructure associated with the mine within the Tshipi Borwa Mining Right and Surface Right area.

Surrounding land uses includes existing mining operations, agriculture (grazing), infrastructure (road, rail network, powerlines, water pipeline, sewage works), solar plant and isolated farmsteads. Activities and infrastructure related to the proposed project may have an impact on land uses within and surrounding the project area. The key related potential environmental impacts include soil, land capability, biodiversity, water, air, noise, visual, and economic impacts. In the unmitigated scenario this is a high severity.

The approved EMPr's (SLR, August 2017 and April 2019), requires that the surface is reinstated to pre-mining state of wilderness and grazing and requires that the open pit is backfilled at closure. The proposed project is proposing a change to this strategy, where the closure land use objective is to create a sustainable closure land use which is a combination of natural habitat creation (aquatic and terrestrial) and availability of water for livestock with associated grazing potential. In the mitigated scenario, where decommissioning activities are controlled according to the existing EMPr and the closure plan is effectively implemented, the severity of the impact, on land uses within and surrounding the project area, changes to a medium and positive. It should be noted that this could be a high positive depending on the success of rehabilitation, however but as a precautionary approach, in the absence of verified on the ground results, this is been rated a medium positive.

Duration

In the unmitigated scenario the duration is high because negative impacts would continue post closure. In the mitigated scenario, a sustainable closure land use would be long term. This is also a high duration.

Spatial scale / extent

Land use impacts are likely to extend beyond the mine in both the unmitigated and mitigated scenarios. This is a medium spatial scale.

Consequence

The unmitigated consequence is high. With management actions the consequence is high and positive.

Probability

In the unmitigated scenario the probability of negative land use impacts on surrounding land uses due to the proposed project is definite. With management actions, the probability of improving land use impacts on surrounding land uses is rated as a medium probability.

Significance

The significance is high and negative in the unmitigated scenario and changes to a high positive with mitigation.

No additional latent impacts have been identified. Depending on the nature and scale of surrounding mining activities at the post closure stage, this could be a cumulative impact category.

Unmitigated and Mitigated – summary of impact

Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated					
H	H	M	H	H	H
Mitigated/Residual impact					
M+	H	M	H+	M	H+

Project impact within the context of approved closure commitments

The impact associated with a change in land use was assessed as part of the approved EMPr's (SLR, August 2017 April 2019). In this regard the significance of the impact was rated high without mitigation, reducing to low with mitigation at closure as the mine site would have been rehabilitated. In the unmitigated scenario, the proposed project does not alter the significance rating. With mitigation, a change in the closure strategy creates and enhances alternative land uses (terrestrial and aquatic habitats) and provides a water resource for livestock watering with associated grazing potential, which changes to significance to high and positive.

Summary of the impact significance rating in the context of the approved commitment

Management	Approved EMPr (August 2017)	Proposed project
Unmitigated	High	High
Mitigated	Low	High and positive

MANAGEMENT OBJECTIVE

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

MANAGEMENT ACTIONS

Management actions to be implemented in include:

- Tshipi will implement the management actions for the decommissioning phase as outlined in the approved EMPr's (SLR, August 2017 an April 2019). These management actions focus on communication with neighbouring communities, land users, and land owners to facilitate information sharing;
- Rehabilitate the overall site to provide for the post closure land use in accordance with the mine Closure Plan. This will happen during the decommissioning phase and will carry through to the closure phase;
- Tshipi will comply with the relevant NEMA provisions regarding closure; and
- Tshipi will comply with the relevant NEMA provisions regarding financial provision for rehabilitation.

APPENDIX F: SOILS, LAND USE AND LAND CAPABILITY STUDY (TERRA AFRICA, JUNE 2019)

APPENDIX G: BIODIVERSITY STUDY (TERRESTRIAL AND AQUATIC) (SAS, MAY 2019)

APPENDIX H: PIT LAKE STUDY (SLR, JUNE 2019)

APPENDIX I: AIR STUDY (AIRSHED, JUNE 2019)

APPENDIX J: NOISE STUDY (AIRSHED, JUNE 2019)

APPENDIX K: VISUAL STUDY (GRAHAM, JUNE 2019)

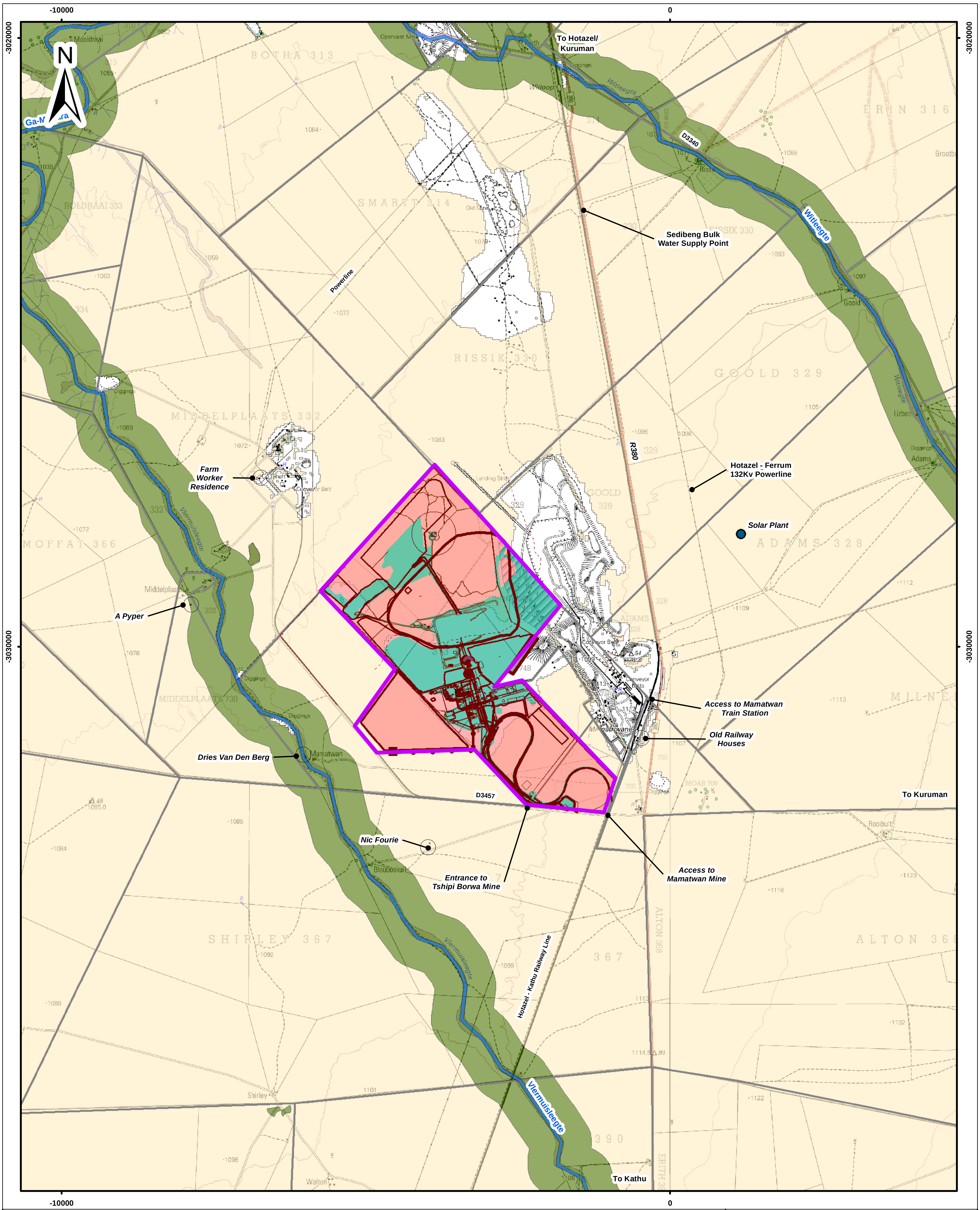
APPENDIX L: ECONOMIC STUDY (MERCURY, JUNE 2019)

APPENDIX M: FINANCIAL PROVISION (SLR, JUNE 2019A)

APPENDIX N: HERITAGE AND PALEONTOLOGICAL EXEMPTION LETTER (PGS, JUNE 2019)

APPENDIX O: COMPOSITE MAP

Figure 19: Composite map



Legend

- Tshipi Surface Use Area
- Mine Infrastructure - Approved
- Barrier Pillar

NFEPA Rivers

- CLASS B: Largely Natural

Critical Biodiversity Areas

- Ecological Support Area
- Other Natural Areas

Sensitivity

- Moderately High Sensitivity
- Low Sensitivity

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 19

Composite Map

SLR

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