APPENDIX D: DETAILED ASSESSMENT OF POTENTIAL IMPACTS

Potential environmental and socio-economic impacts were identified by SLR and stakeholders. All identified impacts are considered both incrementally and cumulatively in the context of the existing and approved Tshipi mining infrastructure and activities. The criteria used to rate each impact is outlined in Section 6.6.

The potential impacts are rated with the assumption that no management actions are applied and then again with management actions. An indication of the phases in which the impact will occur including the project specific activity associated with each impact is provided below. A summary of the impact assessment is provided in Section 8 of the main report.

Management actions identified to prevent, reduce, control or remedy the assessed impacts are provided under the relevant impact discussions sections below. A summary of the management actions is provided in Section 27 of this report. It is important to note that the management actions include all measures outlined in the approved EMPr (SLR, 2017d) and any additional management actions identified as part of the proposed project. All additional management actions are indicated in ***italics***.

Biophysical and social impacts associated with the project that will be assessed in this section include the following:

1. The loss and sterilisation of a mineral resource;
2. The loss of soil resources and land capability through contamination and physical disturbance;
3. The physical destruction and general disturbance of biodiversity;
4. The alteration of natural drainage patterns;
5. The contamination of surface water resources;
6. The contamination of groundwater resources;
7. Air pollution through dust generation;
8. Increase in disturbing noise levels;
9. Negative visual views;
10. Road disturbance and traffic safety;
11. The loss of heritage, cultural and palaeontological resources;
12. Inward migration impact;
13. Economic impact; and
14. A change in land use.

D1. GEOLOGY

ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCES

Information in this section was sourced from the project team.

Introduction

By the nature of mining projects, mineral deposits in the natural geology are exploited for the target minerals; thereby impacting the local geology. It is also possible that mineral resources can become sterilised through the placement of surface infrastructure and waste. These activities already take place on site as the mine is an

existing operation. However, the proposed WRD extensions could present the potential for sterilisation of mineral resources.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
N/A	Mineralised waste	Mineralised waste	Final land forms

Rating of impact

The impact of the loss and sterilisation of mineral resources was assessed as part of the original EMPr (Metago, 2009) and found that the placement of surface infrastructure would not sterilise any mineral resources. The EMPr amendment (SLR, 2017d) did, however, indicate that following detailed work undertaken by Tshipi, it was found that some economically mineable mineral resources had been sterilised by the placement of the northern WRD. The cumulative impact was rated as **high** and reduced to **LOW** with mitigation.

It is understood from Tshipi that the sub-outcrop of the currently economically mineralised resource is located beyond the areas where the East and West WRD extensions are planned. The manganese ore resources underlying Mamatwan portion 8 has been identified as uneconomic by both opencast and underground mining methods through exploration by Mamatwan Mining (Pty) Ltd – who held the Exploration Right and have subsequently applied for the Mining Right, and have concluded a contract(1)[5] with Tshipi to abandon their Mining Right application on the lower portion of portion 8 immediately when granted, in favour of Tshipi in consideration of Tshipi selling the surface rights of the upper portion of portion 8 to Mamatwan Mining, who are planning infrastructure on the northern portion of portion 8. This impact has, therefore, been rated as **insignificant**.

The cumulative impact rating therefore remains unchanged for the overall mine as per the approved EMPr (SLR, 2017d) as follows:

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

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

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

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

[5] Memorandum of Agreement entered into by and between Tshipi é Ntle Manganese Mining Proprietary Limited and Mamatwan Manganese Proprietary Limited, signed on 8 May 2015 and 29 April 2015 respectively.

Management objective

To prevent unacceptable mineral sterilisation or mineral resources.

Management actions

The mine will continue to implement management measures for the overall mine as per the approved EMPr (refer to Section 27) which includes:

- Implement best mining practices during all mine phases to ensure that mineral sterilisation is minimised as far as possible. This includes diligent planning based upon available technical data and other information e.g. economic factors.

D2. TOPOGRAPHY

ISSUE: Altering Topography

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

Introduction

The existing mining operation has altered the natural topography of the area. The establishment of the proposed WRD extensions will further alter the natural topography of the project area. This in turn may impact on surface water drainage (discussed in Section D5) and visual aspects (discussed in Section D7). The proposed powerline and conveyor will not impact on topography and will not be discussed further.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste	Mineralised waste	Final land forms

Rating of impact

Severity/ nature

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 establishment of the proposed WRD extensions will further alter natural topography and cannot be mitigated. However, this impact is considered to be of moderate severity due to the limited areas for the WRD extensions. The cumulative severity is medium for the overall mine and cannot be mitigated to reduce severity.

Duration

Waste rock residue will likely remain on surface in perpetuity.

Spatial scale/ extent

The spatial scale will be limited to the project area.

Consequence

The consequence is medium.

Probability

The impact of a change in topography is definite.

Cumulative impact significance

The significance of this potential impact is medium and cannot be mitigated as the waste rock residue will likely remain on surface in perpetuity.

Unmitigated – summary of the rated cumulative impact of altering natural topography

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

Mitigated – summary of the rated cumulative impact of altering natural topography

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

Management objectives

The objective is to minimise changes to natural topography.

Management actions

Implement the following management actions during all mine phases:

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

D3. SOIL AND LAND CAPABILITY

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

Information in this section is based on the soil study undertaken by TerraAfrica (2018) for the proposed project (refer to Appendix H).

Introduction

Soil is a valuable resource that supports a variety of ecological functions and is the key to re-establishing post closure land capability. Soil resources can be disturbed through removal, erosion and compaction, as well as pollution during accidental spills and leaks which can result in a loss of soil functionality as an ecological driver.

Existing mining activities have already disturbed soils and related land capability through the establishment of related surface infrastructure and mining activities. The proposed WRD extensions, proposed powerline and conveyor infrastructure will require the disturbance of additional soils and associated activities could present additional pollution risks.

A number of activities/infrastructure and sources in all phases have the potential to disturb and pollute soils and related land capability through removal, compaction and/or erosion, accidental spills and leaks. In the construction and decommissioning phases these activities and sources are temporary in nature, usually existing from a few weeks to a few months. The operational phase will present more long-term activities and sources and the closure phase will present final land forms (waste residue that remains on surface).

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

Severity/ nature

The approved infrastructure and activities presents numerous sources of activities soil pollutants that can result in a loss of soils (and associated land capability) as a resource. This in turn can result in a loss of soils as an ecological driver because it can create a toxic environment for vegetation and ecosystems that rely on the soil. The cumulative impact was assessed as part of the approved EMPr amendment (SLR, 2017) as having a **high** overall significance, reducing to **LOW** with mitigation.

The East WRD and conveyors will be established within mining areas and, therefore, not result in significant impacts on soils and land capability. However, the West WRD extension and the powerline will be constructed on land suitable for grazing. When considering the proposed project, the most significant impact on soils will occur during the construction of the West WRD extension and powerline. Topsoil will be stripped from the areas where the powerline and West WRD extension will be developed, which will result in the mixing of natural soil layers or horizons, a loss of topsoil fertility and soil compaction. Land capability will be changed from natural veld suitable for grazing to mining, and this impact is long-term. Soil erosion can occur in areas that have been cleared and accidental spills and leaks can contaminate soil during all mine phases until closure. The severity of this impact has been rated as high.

While successful mine rehabilitation may result in revegetation of affected areas, soil horizons cannot be returned to their original positions and deep soil compaction is difficult to alleviate. Similarly, the change in land capability can only be partially mitigated once the land has been rehabilitated. However, soil erosion and

soil chemical pollution can be prevented or successfully mitigated when implementing the soil management plan diligently. Soil erosion and chemical pollution impacts should become negligible once the site has been successfully revegetated and vehicles and equipment are removed. The severity of this impact has been rated as low in the mitigated scenario.

The cumulative impact on soils is therefore rated as having a high severity, reducing to medium with mitigation. The mitigated scenario rating has therefore been changed from the approved EMPr rating (SLR, 2017d) due to the fact that according to TerraAfrica, soil horizons cannot be returned to their original positions and deep soil compaction is difficult to alleviate.

Duration

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

Spatial scale/extent

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

Consequence

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

Probability

Without any management actions the probability of impacting on soils and land capability is definite. With management actions, the probability will be significantly reduced to low.

Cumulative impact significance

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

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

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

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

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

Management objective

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

Management actions

Implement the following management actions during all mine phases:

- Implement the following management actions during all mine phases:
- Limit land disturbance to those activities and areas that are described in the EMPr. *In this respect, clear instructions will be included in relevant contracts that will restrict construction work and construction workers to clearly defined areas, and compliance to these instructions will be monitored;*
- Implement the soil conservation procedure as set out in Table 27 3;
- Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved;
- *Use existing established roads wherever possible;*
- *Locate new roads that will carry heavy-duty traffic in areas that have been previously disturbed rather than clearing new areas;*
- *Design new roads with a camber to avoid ponding and to encourage drainage to side drains; where necessary, install culverts to allow free drainage;*
- *Protect the side drains on the roads with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary use geo-membrane lining;*
- *Manage the terrain within the mine surface use area to prevent erosion by implementing the following measures:*
    - *Restrict excavation to areas where it is absolutely necessary;*
    - *Use geo-textiles or other suitable means where required to prevent soil erosion;*
    - *Use tracked excavation equipment where possible to reduce soil compaction that leads to higher run-off rates and increased erosion risk.*
    - *Reduce permanent slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and*
    - *Use recognised drainage control measures e.g. side-drains and culverts to manage the natural flow of surface runoff.*
- Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, and in the designs of any permanent landforms e.g. waste rock dumps, approved tailings dam).
- Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants (such as fuels, oils, hazardous chemicals (new and used), dirty water,

mineralized wastes and non-mineralised wastes) are contained at source and do not pollute soils. In this regard:

  - Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps;
  - Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;
  - Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately;
  - Implement and maintain a dirty water management system, as set out in the respective section;
  - Implement the waste management practices, as set out in Table 27-2;
  - Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and
  - Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.

- Determine and implement specifications for post rehabilitation audits 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;
- Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures (such as the waste rock dumps, ore stockpiles and tailings dam); and
- Implement the emergency response procedure in Section 30.2.2 in the event any major spillage incident.

D4. BIODIVERSITY

ISSUE: PHYSICAL DESTRUCTION AND GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the biodiversity study undertaken by STS (2018) (see Appendix E)

Introduction

A number of activities/infrastructure in all phases that have the potential to destroy or disturb biodiversity in the broadest sense, particularly in the unmitigated scenario. In the construction and decommissioning phases these activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long-term occurrences and the closure phase will present final land forms (residual waste rock dumps) that may have pollution potential through long term seepage and/or runoff.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of	Final land forms

Construction	Operational	Decommissioning	Closure
	approved facilities and services Open pit mining	approved facilities and services	

Rating of impact

Severity/nature

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

The cumulative impact associated with the physical destruction and general disturbance of biodiversity was assessed as part of the approved EMPr amendment (SLR, 2017d) as having a **high** overall significance in the unmitigated scenario, reducing to **MEDIUM** with management actions.

When considering the proposed project, the proposed Eastern WRD extension and conveyor are located in already disturbed areas. Therefore, no significant biodiversity impacts are expected with regard to the proposed Eastern WRD extension and conveyor.

The proposed West WRD extension and powerline will require clearing of vegetation within the Kathu Thornveld habitat unit, which has a moderately high ecological sensitivity. The clearing of vegetation will result in the loss of additional protected trees such as the Camel Thorn (*Vachellia erioloba)* and Grey Camel Thorn (*Vachellia haematoxylon),* as well as as well as several other faunal and floral species of conservation concern. A survey conducted in the West WRD extension area found approximately 4 365 Grey Camel Thorn trees and approximately 1 140 Camel Thorn trees.

In addition to the loss of habitat, biodiversity may be disturbed in the following ways:

- Lighting can attract large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances;
- People may kill various types of species for food, for sport, for fire wood etc.;
- People may illegally collect and remove vegetation, vertebrate and invertebrate species;
- Excessive dust fallout from various dust sources (exposed areas, soil stockpiles, etc.) may have adverse effects on the growth of some vegetation, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation;
- Noise and vibration pollution (from vehicle movement, materials handling, etc.) may scare off vertebrates and invertebrates. In some instances the animals may be deterred from passing close to noisy activities which can effectively block some of their migration paths. In other instances, vertebrates and invertebrates that rely on vibration and noise senses to locate for, and hunt, prey may be forced to leave the vicinity of noisy, vibrating activities;
- An increased presence of vehicles in the area can cause road kills especially if drivers speed;

- Vegetation clearing activities will create an ideal scenario for the proliferation of alien invasive plant species, which will result in a further disturbance of terrestrial habitat; and
- An increase in pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

When considered incrementally, this has a medium to high severity in the unmitigated and mitigated scenarios. This will not change the cumulative severity rating of high in the unmitigated scenario, reducing to medium with mitigation.

Duration

In the unmitigated scenario the loss of biodiversity and related functionality is long-term and will continue after the life of the mine. With management actions, biodiversity and related functionality may be partially restored during the operational, decommissioning and closure phases. The duration is, therefore, high in the unmitigated scenario, reducing to medium in the mitigated scenario.

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 and reduces to medium with management actions.

Probability

Without management actions the probability is definite. With management actions, the probability may be reduced with correct management actions and concurrent rehabilitation.

Cumulative impact significance

The significance of this impact is **high** without management actions, reducing to **MEDIUM** with the correct management actions.

Unmitigated – summary of the cumulatively rated loss of biodiversity through physical destruction and general disturbance impact per phase of the mine

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

Mitigated – summary of the cumulatively rated loss of biodiversity through physical destruction and general disturbance impact per phase of the mine

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

Management objective

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

Management actions

Implement the following management actions during all mine phases:

- implement and refine (as needed) the biodiversity action plan, in consultation with DAFF and a suitably experienced and qualified specialist;
- Limit mine infrastructure, activities and disturbance areas to those specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to the identified sensitive habitats and associated species;
- Retain corridors of naturally occurring vegetation within the disturbed areas as far as practicably possible, to provide a corridor for fauna to move out of the disturbed areas;
- *Limit vegetation clearing along the powerline servitude to prevent the powerline from being overgrown and/or affected by veld fire; in accordance with the DAFF guideline (protected trees may only be cleared directly underneath and within 4 metres of the powerline).*
- *Implement phased vegetation clearing of the WRD extension areas, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities;*
- Collect pods of the Camel Thorn (*Vachellia erioloba*) and the Grey Camel Thorn (*Vachellia haematoxylon*) in order to aid in the re-establishment of these species. Take the necessary steps (such as artificial scarring/acid washing) in order to aid in germination of these species, with guidance from a qualified and experienced specialist;
- Plan and implement plans for the removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This includes planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Take the soil conservation procedure and required actions into account when implementing removal plans. Undertake harvesting of seeds in a controlled manner from similar areas within the mine surface use area to aid in rehabilitation of the mining areas. Ensure that all rescue and relocation plans are overseen by a suitably qualified and experienced specialist, who will also advise on the potential for establishing a nursery of plants to be used for rehabilitation;
- Obtain the relevant permits prior to removal of protected plant and/or trees and comply with the requirements thereof;
- Obtain guidance from a suitably qualified and experienced specialist to develop and implement an effective monitoring programme of protected trees in the area of operation, on an individual tree basis and at a community level. Implement additional management actions that may be recommended by the specialist, depending on the results of the monitoring programme;
- Re-vegetate disturbed and cleared areas once no longer in use with indigenous species of flora to help stabilise the soil surface;
- Develop and implement an “after care” programme to manage rehabilitated areas which will aid in ensuring that the correct species are able to re-establish;
- Implement a biodiversity offset, should this be requested by DAFF, in accordance with the relevant biodiversity offset guidelines. Consider the following issues in the biodiversity offset with guidance from DAFF:
    - the size of the potentially affected area;

  - the conservation status of the potentially affected area;
  - the offset ratio (in terms of the required size of the offset site) to be applied;
  - evaluation of alternative offset sites on the basis of: compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Northern Cape including linkages to areas of conservation importance, acceptability to I&APs, management of negative impacts on local communities, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the UMK site;
  - land ownership now and in the future;
  - status/security of the offset site, i.e. will it receive conservation status;
  - measures to guarantee the security, management, monitoring and auditing of the offset;
  - capacity of Tshipi to implement and manage the offset
  - collaboration with surrounding mine's offsets may be an option;
  - identification of unacceptable risks associated with the offset; and
  - the start-up and ongoing costs associated with the offset for the life of the project.
- Implement the emergency response procedure in Section 30.2.2 in the event of major spillage incidents.
- Implement an alien/invasive/weed management programme (Section 0) in collaboration with the DENC and DAFF to control the spread of these plants onto and from disturbed areas. Take care to prevent the encroachment of these species into rehabilitated areas;
- Use appropriate fencing where feasible to keep vertebrates away from illuminated areas;
- Train workers on the value of biodiversity and the need to conserve the species and systems that occur in the mine surface use area;
- Implement a zero tolerance policy with regard to the killing or collecting of any fauna and/or flora by any Tshipi employees and/or contractors or visitors;
- *Implement steps to prevent the propagation and/or spread of veld fires e.g. cutting/burning fire-breaks and put in place as part of the emergency plan a programme, trained individuals and equipment for fire-fighting*
- Implement active speed control measures for any vehicles driving within the mine surface use area;
- Maintain noisy and/or vibrating equipment to limit noise and vibration emission levels;
- Implement dust control measures as discussed under the air quality section in this table;
- Prevent pollution and litter as outlined in Table 27-2 and Table 27-3; and
- Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, including in the designs of potentially polluting structures (mine residue facilities).

D5. SURFACE WATER

ISSUES: ALTERATION OF NATURAL DRAINAGE PATTERNS

The information in this section was sourced from the hydrology study completed by SLR (SLR, 2018a) (refer to Appendix G).

Introduction

With reference to the table below, there are a number of activities/infrastructure that will alter drainage patterns by reducing the volume of runoff into the downstream catchments at the mine. During the construction, operational and decommissioning phase, these activities will continue until such time as infrastructure can be removed and/or the mining areas are rehabilitated. During the closure phase,

rehabilitation will allow for the restoration of drainage patterns. Rainfall and surface water runoff will be collected in all areas that have been designed with water containment infrastructure as required by legislation. The collected runoff will, therefore, be lost to the catchment and can result in the alteration of drainage patterns. The existing operation has already had an impact on the natural drainage of the area, and the proposed infrastructure will further alter the natural drainage.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Water use management	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impacts

Severity/nature

Natural drainage across the project area is via sheet flow and the nearest watercourse is approximately 1 km away from the West WRD extension area. No mining activities take place within the floodlines of this watercourse and this watercourse will not be altered as part of the proposed project.

During all mine phases, rainfall and surface water runoff is collected in all areas that have been designed with water containment infrastructure in order to contain dirty water in compliance with R704 of the NWA. The collected runoff is, therefore, lost to the catchment and can result in the alteration of drainage patterns. The cumulative impact was assessed in the 2017 EMPr amendment (SLR, 2017d) as reducing the runoff to quaternary catchment D41K by 0.152%. This cumulative impact was rated as **medium**, reducing to **LOW** in the mitigated scenario.

The proposed WRD extension will require the collection of additional storm water and reduce the runoff to the quaternary catchment D41K by a further 0.04%. The severity of the loss of runoff to the catchment of the proposed WRD extensions containment infrastructure is expected to be low. This will not change the cumulative impact assessment rating of medium in the unmitigated scenario and low in the mitigated scenario for the overall mine with the re-establishment of runoff patterns as far as practically possible.

Duration

The alteration of drainage patterns will extend beyond closure as the WRDs are likely to remain in perpetuity.

Spatial scale / extent

In the mitigated and unmitigated scenario the physical alteration of drainage patterns will extend beyond the site boundary as flow reduction impacts could extend further downstream.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is medium.

Probability

The probability of the alteration of drainage patterns is definite, but the magnitude of the reduced flows is unlikely to result in substantial deterioration and related flow impacts downstream due to the relatively flat topography, low rainfall and high infiltration rates, therefore the probability is low in both the mitigated and unmitigated scenarios.

Cumulative impact significance

The significance is **medium** without management actions. With management actions the significance reduces to **LOW**.

Unmitigated – summary of the cumulative rated alteration of natural drainage patterns impact per phase of the mine

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

Mitigated – summary of the cumulative rated alteration of natural drainage patterns impact per phase of the mine

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

Management objective

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

Management actions

Implement the following management actions during all mine phases:

- Construct, operate and maintain mine infrastructure in a *manner* that ensures compliance with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include:
    - Separate clean and dirty water systems;
    - Minimise the size and extent of dirty water areas; and
    - Divert clean water (run-off and rainfall) around the mine/dirty areas and back into its normal flow paths in the environment;
- Regularly update and refine the site wide water balance with the input of actual flow volumes to enable the water balance to be used as a decision-making tool for water management and impact management actions (Section 0).

ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES

The information in this section was sourced from the hydrology study completed by SLR (SLR, 2018a) (refer to Appendix G).

Introduction

A number of pollution sources in all phases have the potential to pollute surface water, particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. The operational phase presents more long-term potential sources and the closure phase will present final land forms such as residual waste rock dumps (where applicable) that may have the potential to contaminate surface water through long term seepage and/or runoff. The proposed infrastructure presents additional pollution sources.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Water use management	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impacts

Severity/nature

Mining projects generally present a number of pollution sources that can have a negative impact on surface water quality if unmanaged in all project phases. Various pollution sources during the operational phase include: fuel and lubricants, sewage, mine residue (TSFs and WRDs), dirty water circuit, chemicals, non-mineralised waste (hazardous, general), and erosion of particles from exposed soils in the form of suspended solids. The proposed WRD extensions present additional potential pollution sources as runoff from the WRD extensions could contain contaminants. The construction of the proposed powerline and conveyor infrastructure could present temporary pollution sources through accidental spills and leaks.

The cumulative impact of surface water contamination was assessed as part of the approved EMPr amendment (SLR, 2017d) as having a **medium** overall significance. The mitigated scenario was assessed as having a **LOW** overall significance with key mitigation factors including the diversion of clean water away from dirty areas and the containment and re-use of contaminated runoff and process water.

The establishment of the proposed WRD extensions, powerline and conveyor will present additional pollution sources albeit similar in nature to what has already been assessed for the mine. In the unmitigated scenario,

potential construction and decommissioning phase pollution sources associated with the establishment of proposed infrastructure include:

- Sedimentation from erosion; and
- Spillage of operational fuel, lubricants and leaks from vehicles and equipment.

Potential operational phase pollution sources include:

- Spillage of operational fuel, lubricants and leaks from vehicles and equipment;
- Runoff from the WRDs; and
- Sedimentation from erosion.

At elevated concentrations contaminants can exceed the relevant surface water quality limits imposed by DWS and can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates and invertebrates (refer to the biodiversity section in this appendix for the potential biodiversity impacts. This impact will not be assessed in this section).

When considered incrementally the WRD extensions, powerline and conveyor potential pollution impact has a severity of low in both the unmitigated and mitigated scenarios. A key mitigation factor is that the WRDs will have runoff containment infrastructure. This will not change the cumulative impact assessment rating of **medium** in the unmitigated scenario and **LOW** in the mitigated scenario for the overall mine with the continued implementation of mitigation measures.

Duration

The contamination of surface water resources will occur for the life of the mine in the unmitigated scenario. With management actions, pollution can be prevented and/or managed and as such the impacts can be reduced to less than the mine life.

Spatial scale / extent

In the mitigated and unmitigated scenarios the spatial scale is limited to the mining area given that the nearest river is located 1 km west of the mine and is ephemeral in nature.

Consequence

In the unmitigated scenario the consequence is medium and in the mitigated scenario it is low.

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, the Vlermuisleegte River, which is located 1 km west of the mine, it is unlikely that pollution sources will reach surface water resources. It should also be noted that the Vlermuisleegte is ephemeral in nature and therefore is associated with long periods of no flow.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There is a limited possibility that this will occur given that there is no reliance on surface water resources in the area, for domestic use or livestock watering.

The third element is that it is likely that only some contaminants will be at a level which is harmful to humans and livestock. This is influenced both by the quality of any discharged water and by the diluting effect of any rainwater particularly in the rainy season.

As a combination, when considering the nature and location of the mine in proximity to the Vlermuisleegte River, the unmitigated probability is medium, reducing to low with management actions.

Cumulative impact significance

In the unmitigated scenario, the significance of this potential impact is **medium**. In the mitigated scenario, the significance is reduced to **LOW** because of the reduction in severity, duration and probability.

Unmitigated – summary of the rated cumulative contamination of surface water resources impact per phase of the mine

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

Mitigated – summary of the rated cumulative contamination of surface water resources impact per phase of the mine

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

Management objective

The objective is to prevent pollution of surface water resources.

Management actions

Implement the following management actions during all mine phases:

- Handle all hazardous fuels, oils, chemicals (new and used), mineralized waste and non-mineralised waste in a manner such that they will not pollute surface water. This will be achieved by means of the following actions:
  - Prevent pollution prevention through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to recognised standards;
  - Prevent pollution through considered maintenance of infrastructure and equipment;
  - Prevent pollution through education and training of Tshipi employees and contractors (permanent and temporary);
  - Prevent pollution prevention through appropriate management of hazardous materials as outlined in Table 27-2;
  - Implement appropriate steps to enable containment and remediation of pollution incidents; and
  - Develop post rehabilitation audit criteria to ascertain whether the remediation has been successful. Implement further measures should post rehabilitation audits show rehabilitation has not been successful.
- *Implement the Storm water Management Plan as per the design report;*
- *Manage WRD slope failures which could reduce the capacity of the WRD and/or reduce the effectiveness of WRD paddocks and berms. Rehabilitate any slope failures without delay and recover dislodged/displaced material and return to the WRDs. This also applies to the paddocks and/or berms surrounding the WRDs;*
- *Maintain relevant data sheets for chemical and hazardous substances to provide guidance on the clean-up of chemical and/or hazardous spills;*
- *Conduct regular inspections and maintenance of water management facilities throughout the life of mine, including inspection of drainage structures and liners for;*
  - *any in-channel erosion or cracks;*
  - *de-silt silt traps/sumps and dirty water containment dams; and*
  - *maintain pumps and pipelines according to manufacturer's specifications;*
- *Service vehicles and plant equipment within suitably equipped facilities, either within workshops, or within bunded areas, from which any storm water is conveyed to a collection facility, after passing through an oil and silt interceptor;*
- Monitor surface water quality within and outside the vicinity of mining operations. The surface water monitoring programme must also focus on surface water sampling of different mine dirty water streams, any unplanned discharges, and monitoring both up and downstream of the Vlermuisleegte of the mining operations when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme are outlined in Section 0;
- *Regularly review design measures and mitigation measures for identified impacts as per best practice requirements and in compliance with relevant authorisations, including the WUL;*
- Immediately notify the DWS should any surface water resource contamination be detected. Implement any required actions to stop the contamination of downstream water.
- Notify potentially affected users in the event of surface water contamination, 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, in consultation with DWS and an appropriately qualified person. Address any related proven loss caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity;

- *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site; and*
- Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident.

D6. GROUNDWATER

Information in this section was sourced from the groundwater study undertaken by SLR (2018b) (refer to Appendix G).

The proposed project does not include any dewatering activities; therefore, dewatering impacts assessed in the approved EMPr amendment (SLR, 2017d) will remain valid and will not be discussed in this report. The relevant dewatering management measures are however included in Section 27.

This section focusses on the potential groundwater contamination impacts of the proposed project. The contamination modelling included all existing and proposed sources of pollution in order to provide a cumulative assessment for the mine.

ISSUE: CONTAMINATION OF GROUNDWATER RESOURCES

Introduction

There are a number of sources in all mine phases that have the potential to pollute groundwater. Some existing sources are permanent (approved tailings dam) and some sources are transient (starting later and at different time-steps) and becoming permanent (pit backfilling). Proposed sources include the WRD extensions which are likely to be permanent sources. Even though some sources are temporary in nature, related potential pollution can be long-term. The operational phase will present more long-term potential sources (existing WRDs and proposed WRD extensions) and the closure phase will present final land forms, such as the backfilled open pit and the tailings dam that may have the potential to pollute water resources through long term seepage and/or runoff.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste (existing and proposed sources) Open pit mining (including backfilling)	Mineralised waste (existing and proposed sources) Backfilling of open pit	Final land forms

Rating of impacts

Severity / nature

Groundwater contamination was assessed as part of the original EMPr (Metago, May 2009). The groundwater study supporting the 2009 EMPr found that there would be no significant offsite migration of contaminants and, therefore, the related impact was rated as having a **LOW** significance in the unmitigated and mitigated scenarios. The key contributing factors included:

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

The relocation of surface infrastructure was modelled for the EMPr amendment (SLR, 2017d) using two scenarios:

- Unlined Scenario (unmitigated)
  This scenario modelled the current situation where the WRDs on site are not lined; however, the TSF is lined and was modelled as such.
- Lined Scenario (mitigated)
  In accordance with GNR 635 and GNR 636 waste rock samples tested for Tshipi were classified as Type 1 waste, which would require disposal on a facility with a Class A barrier system. A Class A barrier is designed in such a way to avoid any seepage from the waste facility. A very low hydraulic conductivity was assumed for the areas under the WRDs in this scenario.

The groundwater model was run to simulate a period of 100 years, which included 25 years of mining and 75 years post-mining, and included all existing and potential pollution sources. A chloride source concentration of 2 200 mg/ℓ was simulated for pollution sources. The groundwater model showed a maximum chloride plume would extend up to 990 m from the Mining Right area to the south-west in the unlined scenario, and 840 m in the lined scenario at the end of the simulation (year 100). The assessment found that the changes would not present significantly different contaminants or source types to those previously assessed for all project phases and assessed the cumulative impact as being **low** in the unmitigated scenario because the migration of the pollution plume was expected to be limited and was not expected to impact on third party water users using boreholes for water supply.

The proposed East WRD and West WRD extensions were also modelled using an unlined and lined scenario for a period of 100 years and included all existing and potential pollution sources. The maximum chloride plume is predicted to extend a little over 1.1 km from the West WRD extension area in a western direction (refer to Figure 1) at the end of the simulation (year 100) in the unlined scenario. This results in a plume of low concentration outside of the Mining Right area. However, the only third party borehole which falls within the predicted pollution plume is NT13 which is a Mamatwan Mine monitoring borehole and is not used for abstraction for water supply.

The lined scenario shows a plume that that does not extend as far out from the West WRD extension area when compared to the unlined scenario. The maximum distance the plume extends is approximately 770 m to the west. There are no known third parties using boreholes for water supply within the predicted plumes.

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

When adding the East and West WRD extensions, modelling shows that the addition of the pollution sources do not materially change the overall impact of the mine as assessed in the approved EMPr amendment (SLR, 2017d), which remains rated at a low severity.

Duration

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

Spatial scale / extent

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

Consequence

The consequence is medium in the unmitigated and mitigated scenarios.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach groundwater resources;
- Will people and animals utilise this contaminated water; and
- Is the contamination level harmful?

The first element is that contamination reaches the groundwater resources underneath or adjacent to the mining area. Pollution plume modelling shows that contaminants could reach groundwater resources in the unmitigated and mitigated scenarios. 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 simulated contaminant plume in the unmitigated and mitigated scenarios using boreholes for water supply. The third element is whether contamination is at concentrations which are harmful to users. Based on predicted groundwater modelling, mine related contamination will be at low concentrations outside of the Mining Right area in both the unmitigated and mitigated scenarios. As a combination, the unmitigated and mitigated scenario probability is low.

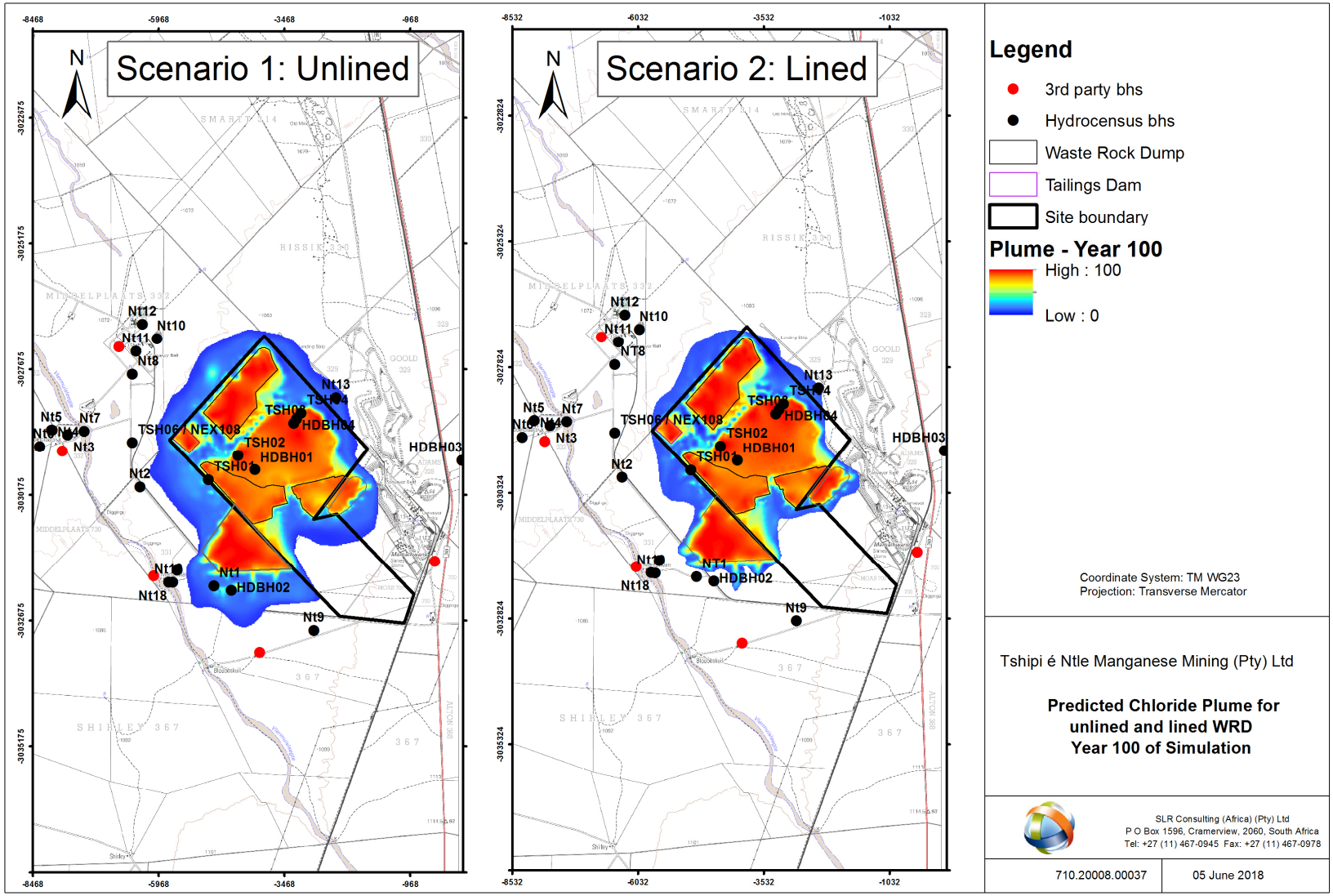

FIGURE 1: PREDICTED CHLORIDE PLUME – YEAR 100 OF SIMULATION (SLR, 2018B)

Cumulative impact significance

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

Unmitigated – summary of the rated cumulative contamination of groundwater impact per phase of the mine

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

Mitigated – summary of the rated cumulative contamination of groundwater impact per phase of the mine

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

Management objective

The objective is to prevent pollution of groundwater resources and related harm to other water users.

Management actions

Implement the following management actions during all mine phases:

- *Implement the Storm water Management Plan as per the design report;*
- Monitor groundwater quality (refer to Section 0 for the monitoring programme). *Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts;*
- Immediately notify the DWS should any groundwater resource contamination be detected off-site;
- Notify potentially affected users in the event of groundwater contamination, 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, in consultation with DWS and an appropriately qualified person;
- Address any water loss proven to be caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity. In the event that Tshipi is proven to be partially responsible for water loss from third party water users, the compensation costs will be shared by all responsible parties;
- *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site;*
- Prevent pollution through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to approved designs;
- Rehabilitate the footprints of temporary waste rock dumps by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period. This will apply to any WRDs that are removed during decommissioning and closure through backfill into the open pit;
- Re-run the groundwater model periodically during the operational phase as and when additional relevant data becomes available, in order to consider potential pollution impacts without the retardation effect of

pit dewatering. If necessary, make for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning;

- Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident;
- Conduct further source term studies to be used for groundwater modelling updates.

D7. AIR QUALITY

ISSUE: AIR POLLUTION

Information in this section was sourced from the air quality study undertaken by Airshed (2018) (see Appendix J), as well as the previous air quality studies (Airshed, 2009 and Airshed, 2017).

Introduction

Mining projects present a number of air pollution sources that can have a negative impact on ambient air quality and surrounding land uses in all phases. Pollution sources include land clearing activities, materials handling, wind erosion from stockpiles, wind erosion of disturbed areas, vehicle movement along unpaved roads and gas emissions mainly from vehicles and generators. These activities already take place on site as the mine is in operation; however, the establishment and operation of the proposed WRD extensions, powerline and conveyor could present additional dust generation sources.

Air pollution related impacts on biodiversity are discussed in the biodiversity section of this appendix and therefore this section focuses on the potential for human health impacts.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Construction works	Mineralised waste Support services Continued use of approved facilities and services Open pit mining	Mineralised waste Support services Continued use of approved facilities and services	Final land forms

Rating of impact

Severity / nature

The main contaminants associated with the mine includes: inhalable particulate matter less than 10 microns in size (PM_{10}) (including a manganese component), larger total suspended particulates (TSP) that relate to dust fallout, SO_2, NO_2 and gaseous emissions mainly from vehicles and generators. The inhalable components can cause human health impacts at high concentrations over extended periods, while the larger particulate component can cause nuisance dust impacts such as soiling of grazing veld at high fallout quantities over extended periods.

Existing mine components that have the potential to contribute to existing ambient emission sources within the area include:

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

The prevailing wind field at the mine is from the south-south-east and south with most of strong winds from the west. Frequent winds also occur from the north. During the day winds are more frequent from the westerly and the northerly sectors, with the strongest winds directly from the west. The wind shifts during the night to south-south-easterly and southerly winds (Airshed, 2018).

The cumulative air pollution impact was assessed for the overall mine in the approved EMPr amendment (SLR, 2017d) as having a high significance. With mitigation the Mn concentrations were predicted to exceed World Health Organisation (WHO) guidelines at a number of residence and farm houses (A. Pyper, Middelplaats and Nic Fourie (refer to Figure 6-17). Dustfall collected at five locations at and around the mine over a period of 16 months indicate high dust fallout levels, exceeding the National Dust Control Regulation (NDCR) limit for non-residential areas of 1 200 mg/m²/day regularly. Ambient PM10 concentrations regularly exceeded the National Ambient Air Quality 24-hour limit of 75 µg/m³, indicating the likelihood of non-compliance with the National Ambient Air Quality Standards (Airshed, 2018). 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. This cumulative impact was rated as HIGH in the mitigated scenario for Mn concentrations.

When considering the proposed project, an increase in gaseous emissions is not foreseen. The main contaminant would be dust, which is discussed below.

During the construction phase, dust will be generated during site clearing activities and topsoil stockpiling for the proposed WRD extensions, powerline and conveyor. The extension of the West WRD is likely to have the most significant impact on air quality due to its size of 142 ha. Windblown dust from the new topsoil stockpiles and cleared areas would only occur when winds exceed 5.4 m/s as a minimum. The planned phased construction method (construction of cells in the WRD extension) will reduce dust generation from land clearing significantly, resulting in less topsoil to be handled and fewer trucks on the roads. Air quality impacts from the construction of the proposed infrastructure are likely to be localised except under stronger winds, which only occur for about 2 % when the dust plume could be carried to the nearby receptors.

During the operational phase, the West WRD extension is likely to be the most significant additional source of air pollution to current mining operations, although the East WRD extension will also generate dust. Additional sources are will mainly due to haul trucks transporting waste rock. Vehicle entrained dust from unpaved roads were the main source of PM_{10} ground level concentrations in the Airshed, 2009 study. Although the mining and waste rock dumping rate will not increase, the travel distances to the WRD extension areas will be longer (further from the pit), resulting in more dust generation due to vehicle entrainment. Dumping of waste rock could also be a significant source of dust.

During the operational phase, dust emissions from conventional conveyors will be wind speed dependent with stronger wind speeds causing dust particles to be entrained by the wind. This could be a significant local source of dust when stronger westerly winds blow during the day, both due to the entrainment potential of the material on the conveyor as well as the spilled material along the conveyor. The conveyor transfer point could also be significant sources of dust generation if not controlled.

During decommissioning, the WRDs will be rehabilitated with the only foreseen source of dust emissions to be truck activity, and tipping and levelling of topsoil on the WRD side slopes.

Taking the above into account, there is potential for increased PM_{10} and $PM_{2.5}$ ground level concentrations and dust fallout rates off-site and at nearby receptors. The receptors most likely to be impacted on by the changes to the infrastructure are N. Fourie to the south and D. van den Berg to the west of the West WRD extension, and to a lesser extent A. Pyper to the north-west of the West WRD extension. This impact is, therefore, rated as having a high severity. With mitigation measures in place these impacts should be limited, and reduce the severity to low.

Increased impacts from the East WRD extension, powerline and the overland conveyor are likely to be insignificant.

The proposed project will therefore not change the cumulative impact of the mine, rated as having a high severity in the unmitigated scenario. The Mn concentrations predicted to exceed World Health Organisation (WHO) guidelines at nearby receptors maintains the high severity in the mitigated scenario.

Duration

Health related impacts could extend beyond closure. With mitigation, the duration of impacts will be limited to the life of the mine. This remains high in the mitigated scenario for Mn concentrations as health related impacts will extend beyond closure.

Spatial scale / extent

The spatial scale of the potential impact could be beyond the immediate mining area in both the unmitigated and mitigated scenarios.

Consequence

Without mitigation the consequence is high. With mitigation the consequence reduces to medium. However, the consequence for Mn remains high in the mitigated scenario.

Probability

The health impact probability is linked to the probability of ambient concentrations exceeding the evaluation criteria in relation to potential receptors. In the unmitigated scenario this is high. With mitigation the probability reduces to medium given that the probability of exceedance at potential receptors reduces.

Cumulative impact significance

The significance of this impact is **high** in the unmitigated scenario. With mitigation, the significance of reduces to **MEDIUM**. However, the mitigated scenario remains **HIGH** for Mn concentrations.

Unmitigated – summary of the cumulatively rated air pollution impact per phase of the mine

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

Mitigated – summary of the cumulatively rated air pollution impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M (H for Mn)	M (H for Mn)	M	M (H for Mn)	M	**M (H for Mn)**

Management objective

The objective is to prevent air pollution health impacts.

Management action

Implement the following management actions during all mine phases:

- Maintain an active and strict (vehicle) speed limit policy;
- Apply suitable dust binding agent and/or water suppression on mine roads. Where dust binding agents are used, this must be limited to the roads only. Should water be used, it is recommended that water be applied at a rate >2 litre/m^2/hour.
- Sweep paved road surfaces as needed to limit dust generation.
- Use effective water sprays at waste rock/ore loading points e.g. tips and conveyor transfer points and during train-loading.
- Use drills fitted with cyclone-type dust extraction systems in the mining pit.
- *Construct the WRD extension in phases thereby limiting the size and extent of pre-stripped ground from which dust can be generated. .*
- *Dump waste rock on the WRDs in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position.*
- *Use dust allaying measures, such as water sprays or equivalent controls to limit the generation of dust, at waste rock tipping points on the WRDs;*
- *Allow topsoil stockpiles and WRD side slopes to re-vegetate naturally. Should re-vegetation cover be insufficient after a rainy season, implement additional dust management measures, such as the use of geotextiles and wind breaks or other methods that are proven to be effective.*
- Maintain a complaints register that is available at the mine. The date and time noted on the complaints register will be the date and time that the reported problem is observed, not the date and time that the complaint is logged. Compare the complaints register to air quality monitoring data, as well as recorded meteorological data, to identify problem areas and then iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources;
- Apply for an air emissions licence for the sinter plant prior to operation;
- Develop and implement an air quality control system which includes inter alia:
    - *Monitor air quality in accordance with Section 0. Three additional dust buckets will be located at the farms of N. Fourie, D. van den Berg and A. Pyper and additional PM10 monitors will be located at D. van den Berg and A. Pyper;*

- *Follow the ASTM D1739 (1970) method as required by the National Dust Control Regulations, with regard to the dustfall unit design, dust collection and analysis; and*
- *Report dustfall results annually to the District Municipality Air Quality officer.*
- *Apply the following criteria with regard to dust and PM10 monitoring at receptors closest to the West WRD extension:*
  - *Dustfall rates must be below 600 mg/m²/day at the identified receptors (farms of N Fourie, D van den Berg and A Pyper) and if exceeded for two consecutive months, action will be taken by identifying the source of dust and applying additional mitigation measures.*
  - *Daily (24-hour) PM10 concentrations will not exceed 75 µg/m³ for more than four (4) days per year at these receptors and should these concentrations be above the limit, immediate action will be taken by identifying the source of dust and applying additional mitigation measures.*

  A possible additional management measure to be considered should it be required, is the wetting of waste rock material prior to tipping onto the WRDs.

- Commission a health risk assessment if monitoring determines that third parties will be exposed to unacceptable cumulative concentrations of manganese or PM_{10} which will focus on the receptors where exceedances are found. Commissioning this health risk assessment, including the implementation of any related management actions, will be the responsibility of both Tshipi and other contributing mines.

D8. NOISE

ISSUES: INCREASE IN DISTURBING NOISE LEVELS

Information in this section is based on the original EMPr (Metago, 2009).

Introduction

Two types of noise are distinguished: noise disturbance and noise nuisance. Noise can be registered as a discernible reading on a sound level meter, while nuisance noise may not register as a discernible reading on a sound level meter, may cause nuisance because of its tonal character (egg. distant humming noises).

Mine activities/infrastructure present the possibility of generating both noise disturbances and noise nuisance in all phases prior to closure. The existing operation generates noise and the proposed construction and operation of the proposed infrastructure presents additional noise sources and locations. Refer to the biodiversity section in this appendix for the potential noise impacts on biodiversity. This section will only focus on the potential human related noise impacts.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Earthworks Construction works	Mineralised waste Support services	Mineralised waste Support services	N/A

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 between 1 km and 2.5 km radius of the Tshipi Borwa Mine (refer to Figure 6-17).

The impact associated with an increase in disturbing noise levels was assessed as part of the original EMPr (Metago, 2009). In this regard, the assessment predicted that unmitigated construction noise would be insignificant both during the day and at night due to the small population density in the area and that significant night time construction work activities were not expected to occur. During operations, in the unmitigated scenario, the assessment predicted that noise impacts would be **insignificant** during the day but greater at night although still **low** due to reduced activities taking place at night.

The development and disposal of waste rock on the WRDs has the potential to increase both day-time and night-time noise levels as operations would occur closer to receptors located in the west. When considered incrementally, this has a medium severity in the unmitigated and mitigated scenarios given the small population density in the area and related distance to potential noise receptors.

It is anticipated that the construction phase will consist of one shift per day for conventional construction activities from 06:00 to 18:00 from Monday to Saturday. Should construction fall behind, or emergency work must be undertaken then working hours may be extended as Tshipi has permission to operate for twenty-four hours per day, seven days per week. Shift rotation will be implemented to ensure work hours do not exceed that permissible by law.

The cumulative severity rating assessing the impact of the changes to the operations within the context of the approved mining operations is medium for day-time noise impacts and medium to high for night-time noise impacts in the unmitigated and mitigated scenarios. The night-time rating is dependent on the sensitivity of noise receptors; which is expected to differ between receptors.

Duration

In both the unmitigated and mitigated scenarios the noise pollution impacts will generally occur until the closure phase of the mine when the noise generating activities are stopped. This is a medium duration.

Spatial scale / extent

The noise footprint of any construction noise is expected to be restricted to the immediate vicinities of construction activities. This is a low spatial scale. In the operational phase, in both the unmitigated and mitigated scenarios the noise impacts will extend beyond the mining area. This is a medium spatial scale.

Consequence

The unmitigated consequence is medium and the mitigated consequence is medium to low for day-time noise impacts and medium for night-time noise impacts.

Probability

The unmitigated probability of the predicted noise increases causing a noise related disturbance at the nearest sensitive receptors is considered to be medium without management actions. With management actions the probability reduces to low for day-time noise impacts and remains medium for night-time noise impacts.

Cumulative impact significance

The unmitigated significance is **medium** and can be reduced to **LOW** for day-time noise impacts. For night-time noise impacts the mitigated significance remains **MEDIUM** given the presence of potentially sensitive noise receptors in areas surrounding the mine.

Unmitigated – summary of the rated cumulative increase in disturbing noise levels impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	H to M	M	M	M	M	**M**

Mitigated – summary of the rated cumulative increase in disturbing noise levels impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M to L (day-time) H to M (night-time)	M	M	M to L (day-time) M (night-time)	L (day-time) M (night-time)	**L (day-time)** **M (night-time)**

Management objective

To prevent public exposure to disturbing noise.

Management actions

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

- Do not blast at night and on Sundays;
- Maintain all diesel-powered earth moving equipment in order to limit noise, including the checking and replacement of exhaust and intake silencers;
- Maintain all haul roads in a good state of repair at all times to avoid unwanted rattle and "body-slap" from vehicles;
- Operate plant and equipment in a proper manner with respect to minimising noise emissions, for example, minimisation of drop heights when loading and no un-necessary revving of engines;
- Locate pumps, generators and compressors behind screening mounds, where possible, and use electrically powered equipment where possible, and/or fit equipment with acoustic covers, as necessary. Install diesel powered pumps, generators and compressors within acoustic enclosures if necessary;
- Record and respond immediately to complaints about disturbing noise. Document and recorded such complaints as incidents, and document the measures taken to address these. Keep these records for the life of mine;
- Undertake noise monitoring following the receipt of a complaint (see Section 0). Where necessary, implement additional management actions to avoid repeat occurrences; and
- *Conduct a once off sampling exercise with input from a specialist at the closest receptors during dumping activities at the West WRD extension. Depending on the outcome of the sampling exercise, implement additional management actions if required.*

D9. VISUAL

ISSUE: NEGATIVE VISUAL VIEWS

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

Introduction

Visual impacts on this receiving environment may be caused by activities and infrastructure in all mine phases. The more significant visual impacts relate to the larger infrastructure components (such as the waste rock dumps) and the long term infrastructure (waste rock dumps which are likely to remain post closure).

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *Construction works*	Mineralised waste Support services Continued use of approved facilities and services	Mineralised waste Support services Continued use of approved facilities and services	Final land forms

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. The visual landscape within the Tshipi Borwa Mine area has been transformed due to the presence of approved mining infrastructure and activities. The visual impact was assessed as part of the approved EMPr amendment (SLR, 2017d) as having a **high** overall significance without mitigation and **MEDIUM** with mitigation, reducing to **LOW** at closure.

The proposed WRD extensions, conveyor and powerline are not expected to influence existing negative visual impacts as these facilities will be established within and adjacent to existing mine infrastructure and will therefore be absorbed by this infrastructure to some extent. When considered incrementally, this has a medium severity in the unmitigated and mitigated scenarios.

The cumulative severity rating assesses the impact of the changes to the visual landscape within the context of the current approved mining operation where there is already similar infrastructure. It follows that this has a medium severity in the unmitigated scenario when considered cumulatively within the context of the current approved operations. The severity is unlikely to reduce with management actions until the closure phase when the site has been rehabilitated (in the mitigated scenario).

Duration

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impact is unlikely to extend post closure because any remaining WRDs will have been rehabilitated.

Spatial scale / extent

In all phases visual impacts are likely to extend beyond the mine in both the unmitigated and mitigated scenarios. This is a medium spatial scale.

Consequence

The unmitigated consequence is high. With management actions, prior to closure, this reduces to medium. After closure the consequence reduces to low.

Probability

In the unmitigated and mitigated scenarios the probability of visual impacts occurring is definite because of the nature of the existing landscape. At closure when the mine site has been rehabilitated, the probability will be reduced to low.

Cumulative impact significance

The unmitigated significance is **high**. The mitigated significance is medium. The mitigated significance reduces **MEDIUM** with mitigation, reducing to **LOW** at closure.

Unmitigated – summary of the rated cumulative negative visual views impact per phase of the mine

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

Mitigated – summary of the cumulative rated negative visual views impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	M	M
Closure						
Mitigated	L	L	M	L	L	L

Management objective

The objective is to limit negative visual impacts.

Management actions

Implement the following management actions during all mine phases:

- Clear the absolute minimum amount of vegetation during construction and operation (phased clearing). This is important on the boundaries of the mine where vegetation can assist with screening;
- Clear and expose only the footprint area as defined by the approved layout in this EMPr. In all other areas, retain the natural vegetation to the extent that of these areas are under the mine's control;
- The air pollution control system will be implemented to avoid plumes of dust;
- Paint and buildings in colours that reflect and compliment the natural landscape where possible;

- Rehabilitate all mined out areas in accordance with the principles of ongoing rehabilitation that includes: backfilling, placement of topsoil and re-establishment of vegetation;
- Effectively rehabilitate the tailings and WRDs which is critical because these will be a permanent post closure features. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities;
- Ensure that all vegetation that is planted as part of rehabilitation will reflect the natural vegetation of the area, as far as is practicable;
- Fit lighting with fixtures to minimise light spillage and focus the light on precise mine activities and infrastructure;
- Shape any residual WRDs left on surface; and
- Manage final rehabilitated areas and landforms remaining in perpetuity through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.

D10. TRAFFIC

ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

Information was sourced from the traffic specialist study (Siyazi, 2017) and the approved EMPr amendment (SLR, 2017).

Rating of impact

Traffic impacts can occur during the construction, operational and decommissioning phases when trucks, buses, and private vehicles make use of the private and public transport network in and adjacent to the Tshipi Borwa Mine. The key potential traffic related impacts relate to road capacity and public safety.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Continued use of approved facilities and services	Continued use of approved facilities and services	Continued use of approved facilities and services	

Discussion

Existing traffic volumes comprising public traffic and traffic from nearby mines that utilise the R380 and D3457 are associated with an acceptable level of service in the context of the existing public and private road infrastructure. However, the traffic study (Siyazi, 2017) did indicate that the intersection at the railway crossing on D3457 to the Tshipi Borwa Mine was not adequate from a road safety perspective. Safety risks associated with mining traffic making use of public road infrastructure include pedestrian accidents and vehicle accidents.

The impact of road disturbance and traffic safety was assessed as part of the original EMPr (Metago, 2009) as having a **medium** overall significance, reducing to **LOW** with management actions. Mitigation measures include addressing the safety issue at the railway crossing on D3457 to the Tshipi Borwa Mine. The approved EMPr amendment (SLR, 2017) noted no significant additional road disturbance and traffic safety impacts.

The proposed WRD extensions, powerline and conveyor infrastructure is not expected to generate additional traffic. The mine implements measures to manage traffic and road safety in accordance with the approved EMPr amendment (SLR, 2017). Consequently the potential for increased traffic and road safety risks due to project activities is expected to be **negligible**. The management actions in the approved EMPr will continue to be implemented by Tshipi.

The cumulative impact rating therefore remains unchanged for the overall mine as per the original EMPr (Metago, 2009) as follows:

Unmitigated – summary of the rated road disturbance and traffic safety impact per phase of the mine

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

Mitigated – summary of the rated road disturbance and traffic safety impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	L	M	M	L	M	**L**

D11. HERITAGE/CULTURAL AND PALEONTOLOGICAL RESOURCES

ISSUE: LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

Information in this section was sourced from the heritage study undertaken by PGS (PGS, 2018) for the proposed project (Appendix I), as well as the previous heritage studies (PGS, 2009 and PGS, 2017).

Introduction

The establishment of the proposed WRD extensions, powerline and conveyor infrastructure has the potential to damage or destroy heritage/cultural resources, either directly or indirectly. This could result in the loss of the resource for future generations, if such resources are present, particularly within the proposed West WRD extension footprint.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Earthworks Construction works	Mineralised waste Support services	Mineralised waste Support services	N/A

Discussion

The 2009, 2017 and 2018 heritage studies have found no heritage resources within the Tshipi Borwa Mine area and the proposed additional infrastructure areas. In addition, there is a low possibility of palaeontological

resources occurring in the area. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below cover the steps to be taken should there be a chance find.

Management objective

To minimize the disturbance of heritage resources.

Management actions

- Consult a professionally registered heritage and/or palaeontological specialist to make associated recommendations that will be complied with prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance at the mine.
- Implement the emergency response procedure (Section 30.2.2) if there are any chance finds of heritage/ cultural or paleontological sites.

D12. SOCIO-ECONOMIC

ISSUE: INWARD MIGRATION

Introduction

Mining operations tend to bring with them an expectation of employment in all phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. This section focuses on the potential for the inward migration and associated social issues.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Construction works	Mineralised waste Support services Continued use of approved facilities and services	Mineralised waste Support services Continued use of approved facilities and services	Closure activities in line with closure plan

Discussion

The original EMPr (Metago, 2009) assessed inward migration as having a **high** overall significance, reducing to **LOW** with mitigation. The approved EMPr amendment (SLR, 2017d) found no material change in the predicted impacts.

Given that the project forms part of an existing approved mine the establishment of additional facilities and activities will not generate any additional employment opportunities as Tshipi will make use of existing contractors and workers on site. Mitigating factors such as the monitoring of workers' living conditions, recruitment disciplines and HIV/Aids awareness and management already exist. As a result the potential for increased social risks due to the proposed project activities is negligible. Therefore, the predicted impact assessment remains in accordance with the original EMPr (Metago, 2009). In this regard, the unmitigated

significance is **high** and **LOW** with management actions. The management actions in the approved EMPr (SLR, 2017d) will continue to be implemented by Tshipi.

Unmitigated – summary of the rated inward migration impact per phase of the mine

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

Mitigated – summary of the rated inward migration impact per phase of the mine

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

ISSUE: ECONOMIC IMPACT

Introduction

In the broadest sense, all activities associated with the mine contribute towards a positive economic impact in all phases. Mining has a positive net economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Construction works	Mineralised waste Support services Continued use of approved facilities and services	Mineralised waste Support services Continued use of approved facilities and services	Closure activities in line with closure plan

Discussion

The original EMPr (Metago, 2009) assessed the positive economic impact as having a medium to high overall significance, and remaining at medium in the mitigated scenario. The approved EMPr amendment (SLR, 2017d) found no material change in this predicted positive impact.

The proposed project forms part of an existing approved mine and the proposed project will not generate any significant additional employment opportunities as Tshipi will make use of existing contractors and workers on site. Mitigating factors such as recruitment and procurement processes already exist. As a result the potential for increased economic benefits due to project activities is expected to be negligible. The cumulative impact rating therefore remains unchanged for the overall mine as per the original EMPr (Metago, 2009), i.e.

MEDIUM-HIGH positive with and without mitigation. The management actions in the approved EMPr amendment (SLR, 2017d) will continue to be implemented by Tshipi.

Unmitigated – summary of the positive economic impact per phase of the mine

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

Mitigated – summary of the rated positive economic impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning and closure						
Mitigated	M+	M	M	M	H	**M-H+**

D13. LAND USE

ISSUE: CHANGE IN LAND USE

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

Introduction

Mining activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. Tshipi operations have already changed the land use in the mining area. The proposed West WRD extension and powerline will further change land use in the area. The East WRD extension and conveyor will be established within the existing mining area and will not change the current land use.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

Severity

Land use within the project area includes existing mining activities and infrastructure associated with the mine within the Tshipi Borwa Mining Rights area. Portion 8 of Farm Mamatwan 331 where the proposed West WRD extension will be located is fenced, therefore no ad-hoc livestock grazing takes place here.

Surrounding land use includes existing mining operations, agriculture, infrastructure (road, rail network, powerlines, water pipeline, sewage works), solar plant and isolated farmsteads. Activities and infrastructure related to the proposed WRD extensions and powerline may have an impact on land uses within and surrounding the project area in all phases. The key related potential environmental impacts include loss of soil, loss of biodiversity, pollution of water, dewatering, air pollution, noise pollution, damage from blasting, visual impacts and the influx of job seekers with related social ills.

The cumulative impact of a change in land use was assessed in the approved EMPr amendment (SLR, 2017d) as having a **medium** overall significance, and **LOW** significance with mitigation.

The West WRD extension is approximately 128 ha in extent. The powerline will follow property boundaries and will be limited in extent (2.5 km with 22 m servitude). The change in land use is considered to have a low severity given that mining is the dominant land use in the project area. As such, the cumulative impact rating in the approved EMPr (Metago, May 2009) remains unchanged.

Duration

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impact duration will be reduced because all any remaining WRDs will have been rehabilitated.

Spatial scale / extent

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

Consequence

The unmitigated consequence is high. With management actions, prior to closure, this reduces to medium. After closure the consequence reduces to low.

Probability

In the unmitigated and mitigated scenarios the probability of a change in land use is definite. At closure when the mine site has been rehabilitated, the probability will be reduced to low.

Cumulative impact significance

The unmitigated significance is **high**. The mitigated significance is **MEDIUM**. The mitigated significance would reduce to **LOW** at closure.

Unmitigated – summary of the rated cumulative land use impact per phase of the mine

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

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

Mitigated – summary of the cumulative land use impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	M	**M**
Closure						
Mitigated	L	L	M	L	L	L

Management objective

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

Management actions

The following management actions will be implemented in all phases:

- *Liaise with Eskom regarding the tie in of the 11 kV powerline into the 132/11kV Eskom sub-station;*
- Communicate with neighbouring communities including land users and owners and other key stakeholders as required to facilitate information sharing and environmental impact management relevant to the mine and its associated infrastructure and activities;
- Repair any damage to Openserve infrastructure as a result of Tshipi's operations;
- Contact Openserve in the event that any Openserve infrastructure needs to be altered or relocated two weeks prior to the commencement of any work. Submit as built plans within 30 days of completion of construction; and
- *Rehabilitate the overall site to provide for the post closure land use in accordance with the mine Closure Plan.*