APPENDIX D DETAILED ASSESSMENT OF IMPACTS

Potential biophysical and socio-economic impacts were identified by SLR, specialists and stakeholders. The impacts are discussed under issue headings in this section. It should be further noted that cumulative impacts and latent impacts are discussed where relevant. The criteria used to rate each impact is outlined in Section 7.6. Where applicable, impacts have been considered both incrementally and cumulatively in the context of the existing UMK operations.

The potential impacts are rated with the assumption that no management actions (which assume that no consideration is given to the mitigation of environmental and social impacts) are applied and then again with management actions which is the mitigated scenario and represents the residual impact. In addition to this, the section below also provides a discussion on the impact significance of the Proposed project within the context of the existing environment within the UMK Mine. A summary of the impact assessment is provided in Section 9 of the main report.

Management actions identified to prevent, reduce, control or remedy the assessed impacts are provided under the relevant impact discussions sections below. A summary of the management actions is provided in Section 26 of this report. Where impacts are considered to be insignificant, no management actions have been identified. Where additional management actions are required as a result of the proposed project to those outlined in the approved EMPr are included in italics.

TOPOGRAPHY

ISSUE: LOSS / STERILISATION OF MINERAL RESOURCES

DESCRIPTION OF IMPACT

Mineral resources in mining operations are typically sterilised by disposal of feasible mineral resources onto the waste rock dumps as well as placement of infrastructure above mineable resources. In this regard, mineral resources can be sterilized and/or lost in the event that UMK disposes feasible mineral resources onto the proposed waste disposal facilities such as waste rock dumps.

Sterilisation of mineral resources can also occur through placement of project infrastructure above the mineable resources. However, the approved EMPr assessed that placement of infrastructure would not sterilise any mineral resources as it may be feasible for these resources to be mined in the future.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operational	Decommissioning	Closure
N/A			
	Mineralised waste Open pit mining	Mineralised waste Open pit mining	Maintenance and aftercare Rehabilitation of landforms and rehabilitated areas

DISCUSSION

Intensity

The optimisation of the mine pits during operation will generate additional material which will be deposited onto the waste rock dumps and be backfilled into the pits. The intensity of sterilising mineral resources is considered to be medium because of the associated potential economic value that is lost when sterilisation occurs.

Duration

The sterilisation of resources will extend beyond the life of mine. This is a long-term duration. With mitigation this reduces to the life of mine.

Spatial scale / extent

If sterilisation of a resources occurs it is likely that the related impact would extend beyond the life of mine and extend beyond the site boundary if one considers the economic nature of the impact.

Consequence

The unmitigated consequence is high. The mitigated consequence is medium.

Probability

Without mitigation the probability is possible. With the implementation of management actions, planning structures will be in place to avoid infrastructure and development related sterilisation which reduces the probability to low.

Significance

The associated significance is medium. In the mitigated scenario, with planning and co-ordination to prevent the unacceptable sterilisation of resources the impact can be reduced to low.

Issue: Loss / sterilisation of mineral resources		
Phases: Construction and operational phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Very High	High
Extent	Medium	Medium
Consequence	High	Medium
Probability	Medium	Low
Significance	Medium	Low
Nature of cumulative impacts	Insignificant contribution to cumulative impacts	
Degree to which impact may cause irreplaceable loss of resources	Likely with mitigation	
Degree to which impact can be mitigated	Likely with mitigation	

Issue: Loss / sterilisation of mineral resources	
Phases: Construction and operational phase	
Degree to which impact may cause irreplaceable loss	Loss where mitigation measures are not correctly implemented.
Degree to which impact can be mitigated	High

MANAGEMENT OBJECTIVE AND OUTCOME

To prevent unacceptable mineral sterilisation.

MANAGEMENT ACTIONS

- Both the approved mine plan and infrastructure layout prevent sterilisation of third-party minerals. This issue will be considered by the mine geologist, environmental manager and mine manager in the pre-feasibility/planning stage of any proposed changes to the mine plan and infrastructure layout.

ISSUE: SAFETY TO THIRD PARTIES AND ANIMALS

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. The existing mining related activities have altered the natural topography and in turn creates the potential risk of injury and/or death to both third parties and animals. The proposed project is located within an existing mining footprint and does not present any new infrastructure or activities that differ from those already approved. Further to this, the footprint of the proposed project is within a restricted area with enforced health and safety policies. This impact has therefore been rated as being Insignificant and has not been assessed further.

SOIL AND LAND CAPABILITY

Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. Project activities have the potential to disturb soils and related land capability through removal, compaction, pollution and/or erosion. The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. In the construction and decommissioning phases these activities could be temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long-term activities and the closure phase will present rehabilitated areas that may be susceptible to erosion.

ISSUE: SOIL EROSION

DISCUSSION

Intensity

Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. Soil resources can be lost through physical disturbance such as soil erosion (erosion and compaction). This in turn can result in a loss of soils as an ecological driver because it can create a toxic environment for vegetation and ecosystems that rely on the soil. The proposed project is located on several farm portions, the majority of which is located within disturbed areas (existing mining operations) but also on undisturbed areas. The proposed project will cover an area of approximately 951 ha. Soil erosion is a measurable deterioration that will occur through vegetation removal from the soil surface. Given that soil erosion has the potential to cause indirect impacts, the intensity is rated as high in the unmitigated and mitigated scenarios.

Duration

The impact is permanent in the unmitigated scenario and can be reduced in the mitigated scenario. The duration is therefore very high in the unmitigated scenario and high in the mitigated scenario.

Spatial scale / extent

The impact of soil erosion is localised because the risk occurs within the site boundary; however, the spatial scale may extend beyond the site boundary if unmitigated. Therefore, the extent is rated as low and very low, in the unmitigated and mitigated scenarios, respectively.

Consequence

Consequence is High in the unmitigated scenario and reduces to medium with mitigation.

Probability

In both the unmitigated and mitigated scenarios, the proposed project may cause probable soil erosion, rated as high.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of the impact is reduced to medium.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management	Maintenance and aftercare of final landforms

Issue: Soil erosion		
Phases: Construction and operational phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Very High	High
Extent	Low	Very Low
Consequence	High	Medium
Probability	High	High
Significance	High	Medium
Nature of cumulative impacts	No cumulative impacts have been identified.	
Degree to which impact may cause irreplaceable loss of resources	Highly unlikely	
Degree to which impact can be mitigated	High	
Degree to which impact can be reversed	Unlikely where vegetation has been removed, highly likely beyond the project footprint.	

MANAGEMENT OBJECTIVE AND OUTCOME

The objective is to minimise the loss of soil resources and related land capability from soil erosion. The outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.

MANAGEMENT ACTIONS

The following management actions will be implemented to manage the impact:

- Limit vegetation clearance to only the areas where the surface infrastructure will be constructed;
- Avoid parking of vehicles and equipment outside of designated parking areas;
- Plan vegetation clearance activities for dry seasons (late autumn, winter, and early spring);
- Design and implement a Stormwater Management System where run-off from surfaced areas is expected;
- Reduce the slope gradients along haul roads and other disturbed areas to gradients at or below the angle of repose;
- Re-establish vegetation along the proposed surface infrastructure to reduce the impact of run-off;
- Regularly check all stockpiles and bare surfaces around infrastructure areas, for signs of soil erosion. In the case of any onset of soil erosion being detected, the surfaces must be rehabilitated through the use of geotextiles accompanied by seeding of indigenous vegetation;
- In the case of any onset of soil erosion being detected, the surfaces must be rehabilitated through the use of geotextiles accompanied by seeding of indigenous vegetation; and
- A Stormwater Management Plan that minimizes the impact of surface water run-off, must be adhered to.

ISSUE: DISTURBANCE OF ORIGINAL SOIL PROFILES

DISCUSSION

Intensity

The disturbance of original soil profiles and horizon sequences of these profiles during earthworks (stripping of topsoil) is a measurable deterioration. Once rehabilitation of the pit area has commenced, the rehabilitated soil profiles will be a new soil with properties that may resemble some of the original soil properties but that may also be altered because of the mixing of soil horizons. The “new” soil can still be used for re-vegetation and successful rehabilitation practices will be able to restore the grazing capacity of the land over a period of time. In this regard, the disturbance of original soil profiles is rated high in the unmitigated and medium in the mitigated scenarios, respectively.

Duration

The impact is permanent in the unmitigated scenario and can be reduced in the mitigated scenario. The duration is therefore very high in the unmitigated scenario and high in the mitigated scenario.

Spatial scale / extent

The impact of original soil profile disturbance is localised because the risk occurs within the site boundary; however, the spatial scale may extend beyond the site boundary if unmitigated. Therefore, the extent is rated as low and very low, in the unmitigated and mitigated scenarios, respectively.

Consequence

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

Probability

In the mitigated and unmitigated scenarios, the proposed project may cause probable original soil profile disturbance, rated as High.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of the impact is reduced to medium.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management	Maintenance and aftercare of final landforms

Issue: Disturbance of original soil profiles		
Phases: Construction phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Very High	High
Extent	Low	Very Low
Consequence	High	Medium
Probability	High	High
Significance	High	Medium
Nature of cumulative impacts	No cumulative impacts have been identified.	
Degree to which impact may cause irreplaceable loss of resources	Highly unlikely	
Degree to which impact can be mitigated	High	
Degree to which impact can be reversed	Unlikely where vegetation has been removed, highly likely beyond the project footprint.	

MANAGEMENT OBJECTIVE AND OUTCOME

The objective is to minimise the loss of soil resources and related land capability from soil chemical pollution. The outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.

MANAGEMENT ACTIONS

The following management actions will be implemented to manage the impact:

- Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained using a drip tray with plastic sheeting filled with absorbent material;
- Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint;
- Unnecessary land clearance must be avoided; and
- Level any remaining topsoil that were removed from the project area and that remained on the surface instead of allowing small stockpiles of soil to remain on the surface.

ISSUE: SOIL CHEMICAL POLLUTION

DISCUSSION

Intensity

The proposed project presents the potential for soil chemical pollution because of potential oil and fuel spillages from vehicles in both operation and construction phases. This impact will also be a risk during other phases of development. The pollution of soils is considered to be a low deterioration of the soil resource; therefore, the intensity is rated as low in both the unmitigated and mitigated scenarios.

Duration

The impact is likely to cease at the end of the mining operation and therefore the duration in both the mitigated and unmitigated scenarios is rated as high.

Spatial scale / extent

The impact of soil chemical pollution is localised because the risk occurs within the site boundary; however, the spatial scale may extend beyond the site boundary if unmitigated. Therefore, the extent is rated as low and very low, in the unmitigated and mitigated scenarios, respectively.

Consequence

The consequence is Medium in the unmitigated scenario and reduces to low in the mitigated scenario.

Probability

In the unmitigated scenario, the proposed project may cause possible soil chemical pollution, rated as medium. Mitigation measures aimed at controlling soil chemical pollution may cause improbable pollution, therefore rated as very low.

Significance

In the unmitigated scenario, the significance of this potential impact is medium. In the mitigated scenario, the significance of the impact is reduced to very.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	**Closure**
Site preparation Earthworks Civil works	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management	Maintenance and aftercare of final landforms

Issue: Soil chemical pollution		
Phases: Construction		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	High	High
Extent	Low	Very low
Consequence	Medium	Low
Probability	Medium	Very Low
Significance	Medium	Very Low
Phases: Operation		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very High	Low
Duration	High	High
Extent	Low	Very Low
Consequence	High	Low
Probability	High	Low
Significance	High	Very Low

Issue: Soil chemical pollution	
Phases: Construction	
Nature of cumulative impacts	No cumulative impacts have been identified.
Degree to which impact may cause irreplaceable loss of resources	Highly unlikely
Degree to which impact can be mitigated	High
Degree to which impact can be reversed	Highly likely with remediation.

MANAGEMENT OBJECTIVE AND OUTCOME

The objective is to minimise the loss of soil resources and related land capability from soil chemical pollution. The outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.

MANAGEMENT ACTIONS

The following management actions will be implemented to manage the impact:

- Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained using a drip tray with plastic sheeting filled with absorbent material;
- Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids, recovering contaminated soils and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area;
- Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste;
- Containing potentially contaminating fluids and other wastes; and
- Cleaning up areas of spillage of potentially contaminating liquids and solids.

ISSUE: SOIL COMPACTION

DISCUSSION

Intensity

Soil compaction during construction will occur as a result of the heavy vehicles and equipment moving over the soil surface in areas where infrastructure will be constructed. In the areas where the hard parking area, the workshop and the offices will be constructed, soil will be deliberately compacted to stabilise the surface and to meet engineering requirements for compacted surfaces underneath structures. The weight of the sand stockpiles will also compact the surface underneath. During the operational phase, soil compaction will occur as a result of heavy vehicles and equipment moving over the soil surface. The intensity is rated as medium in the unmitigated and mitigated scenarios.

Duration

Soil compaction will result in a moderate disturbance of the soil quality and will remain permanent (very high duration) in the unmitigated scenario and high in the mitigated scenario.

Spatial scale / extent

Without mitigation measures, the extent of the impact may affect the entire site (low extent). With the implementation of mitigation measures, the extent can be limited to only the development footprint.

Consequence

The consequence is high in the unmitigated scenario and reduces to low in the mitigated scenario.

Probability

In the unmitigated and mitigated scenarios, soil compaction is probable, rated as high.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of the impact is reduced to medium.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services	Open pit mining Processing Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management	Maintenance and aftercare of final landforms

Issue: Soil erosion		
Phases: Construction, operational and decommissioning phases		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Very High	High
Extent	Low	Very Low
Consequence	High	Medium
Probability	High	High
Significance	High	Medium
Nature of cumulative impacts	No cumulative impacts have been identified.	
Degree to which impact may cause irreplaceable loss of resources	Highly unlikely	
Degree to which impact can be mitigated	High	
Degree to which impact can be reversed	Highly likely with remediation.	

MANAGEMENT OBJECTIVE AND OUTCOME

The objective is to minimise the loss of soil resources and related land capability from soil compaction . The outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.

MANAGEMENT ACTIONS

The following management actions will be implemented to manage the impact:

- Minimize the areas of activity to that indicated in the infrastructure layout;
- The activities of construction contractors or employees will be restricted to the planned areas; and
- Roads that will carry heavy-duty traffic should be designed in areas previously disturbed rather than clearing new areas.

ISSUE: LOSS OF GRAZING CAPABILITY

DISCUSSION

Intensity

In the unmitigated scenario, physical soil disturbance can result in a loss of grazing land capability as a result of the proposed surface infrastructural changes. When considered incrementally, and in the context of the current mining operations, this impact has a medium intensity in the mitigated and unmitigated scenario.

Duration

In the unmitigated and mitigated scenarios, the loss of soil and related land capability is long term and will continue after the life of the project**.**

Spatial scale / extent

In the unmitigated scenario, the potential loss of soil and land capability through physical disturbance will be restricted to within the project area and can be limited to the project footprint in the mitigated scenario.

Consequence

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

Probability

Without any mitigation the probability of losing soil and related land capability is probable. With mitigation, the probability will be reduced to medium because emphasis will be placed on mitigating soil impacts to support rehabilitation.

Significance

In the unmitigated scenario the impact is high. In the mitigated scenario the significance of this impact is reduced to medium.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	N/A	N/A	N/A

Issue: Loss of grazing capability		
Phases: Construction phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Very High	Very High
Extent	Low	Very Low
Consequence	High	Medium
Probability	High	Medium
Significance	High	Medium

Issue: Loss of grazing capability	
Phases: Construction phase	
Nature of cumulative impacts	No cumulative impacts have been identified.
Degree to which impact may cause irreplaceable loss of resources	Highly unlikely
Degree to which impact can be mitigated	High
Degree to which impact can be reversed	Highly likely with remediation.

MANAGEMENT OBJECTIVE AND OUTCOME

The objective is to minimise the loss of soil resources and related land capability from soil chemical pollution. The outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.

MANAGEMENT ACTIONS

The following management actions will be implemented to manage the impact:

- Minimize the areas of activity to that indicated in the infrastructure layout;
- The activities of construction contractors or employees will be restricted to the planned areas;
- Implement a rehabilitation plan in all areas of temporary disturbance to restore the natural vegetation of the area; and
- Conserve topsoil volumes and quality for use during the final rehabilitation to ensure that natural vegetation can be re-established in order to return the land to grazing land capability.

BIODIVERSITY

ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Areas of ecological sensitivity include functioning biodiversity areas with species diversity and associated intrinsic value. Linkages between these areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas, which is a key function for a broader ecosystem. The transformation of land for any purpose increases the destruction of the site-specific biodiversity, the fragmentation of habitats, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between different areas of biodiversity importance. Parts of the project area has been transformed to support the establishment of the UMK mine. The proposed infrastructural changes can destroy biodiversity through additional loss of natural vegetation, additional loss of protected flora and faunal species of conservation concern and Intentional/accidental killing of fauna.

DISCUSSION

Intensity

The proposed infrastructural changes have the potential to contribute to transformation of biodiversity if not managed. The project footprint for the waste rock dumps product stockpile and truck staging area fall within areas of moderate to high ecological sensitivity. This is attributed to the presence of the number of protected trees species that occur within them. It should be noted that these ecological sensitive areas comprise of isolated pockets of biodiversity areas which do not provide ecological linkages required to support conservation. Taking the above into consideration, the severity is very high in the unmitigated scenario where rehabilitation has not been implemented effectively and reduced medium in a mitigated scenario.

Duration

The loss of biodiversity and related functionality is permanent and will continue after the life of the project. With mitigation, biodiversity and related functionality may be partially restored during the operational, decommissioning and closure phases. The duration is therefore very high in the unmitigated scenario, reducing to medium in the mitigated scenario.

Spatial scale / extent

Given that biodiversity processes are not confined to the proposed project area, the spatial scale of impacts will extend beyond this boundary (medium) in the unmitigated scenario, reducing to low in the mitigated scenario.

Consequence

In the unmitigated the consequence is high and reduces to moderate with mitigation.

Probability

Without mitigation the probability is probable. With mitigation, the probability may be reduced with correct management measures.

Significance

The significance of this impact is expected to be high in the unmitigated scenario and can be reduced to medium with a comprehensive rehabilitation plan.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system	Maintenance and aftercare of final landforms.

Construction	Operation	Decommissioning	Closure
	Continued use of approved facilities and services General site management Rehabilitation	Continued use of approved facilities and services General site management Demolition Rehabilitation	

Issue: Additional loss of Natural vegetation, loss of protected floral & faunal species, alien invasion and further habitat fragmentation		
Phases: Planning and Design, Construction		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Very High	High
Extent	Medium	Low
Consequence	High	Medium
Probability	High	High
Significance	High	Medium
Issue: Intentional/accidental killing of fauna		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	High	Medium
Extent	Medium	Low
Consequence	Medium	Low
Probability	Medium	Medium
Significance	Low	Very Low
Nature of cumulative impacts	Insignificant contribution to cumulative impacts	
Degree to which impact may cause irreplaceable loss of resources	Loss where mitigation measures are not correctly implemented	
Degree to which impact can be mitigated	High	
Degree to which impact can be reversed	Likely with mitigation	

MANAGEMENT OBJECTIVE AND OUTCOME

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

MANAGEMENT ACTIONS

- Implement a comprehensive rehabilitation plan to revegetate the area will mitigate the impact to biodiversity to some extent. Generally, it is recommended that to mitigate the effects of mining a complete rehabilitation/restoration of an area to the pre-mining state is required. In arid and semi-arid environments however, the restorative processare often very slow, and it can take several decades for a system to be restored its pre-mining state, but the likelihood of the area reaching this ideal state is not very high. In these arid systems its often more realistic to settle for a functioning state rather than a pre-mining state, which is what is considered in terms of post mitigation assessment;
- The re-vegetation plan must include the establishment of protected trees within the rehabilitated areas. The progress of tree growth and recruitment must be monitored and actively managed to ensure that the rehabilitated areas reflect the surrounding vegetation in terms of structure and composition; and
- A search and rescue operation is not a feasible or practical option for these protected trees. Where protected trees occur within the planned infrastructure areas, losses can be lessened by re-designing the infrastructure which will minimize the impact to individual trees.

SURFACE WATER

ISSUES: ALTERATION OF NATURAL DRAINAGE PATTERNS

There are a number of catchment reduction sources in all project phases that have the potential to impact surface water flows, particularly in the unmitigated scenario. In the construction, decommissioning and closure phases these potential decreases in catchment runoff are temporary in nature. The operational phase will present more long-term potential catchment runoff loss depending on whether the nature of the modified catchment is clean or dirty. Without considering any mitigation measures or water management measures, the collection of stormwater, physical alteration of drainage lines will reduce catchment runoff flows and flood flows to the watercourses. This impact deals with the Operational Phase.

DISCUSSION

Intensity

In the unmitigated scenario, the proposed project presents additional sources of contaminants that has the potential to pollute surface water resources through accidental spills and leaks from trucks. Therefore, these catchments are contained. This results in a reduction in catchment contributing area to the overall catchment runoff. The related unmitigated severity is low. In the mitigated scenario, any dirty surface water run-off from the proposed project areas will be contained within the existing stormwater management infrastructure. Furthermore, the overall objective is to ensure that dirty water is contained and reused rather than discharged into the environment. The mitigated severity is therefore very low.

Duration

The project area is minor compared to the size of the overall Ga-Mogara and Witleegte streams, catchments, and the severity of reduction in runoff flows is medium.

Spatial scale / extent

The extent of this impact will extend to beyond the site boundary, affecting the immediate neighbours, making it medium for both mitigated and unmitigated extents

Consequence

In the unmitigated scenario, the consequence is low as the impacts could affect only the local catchment.

Probability

The probability is definite in both the mitigated and unmitigated scenarios.

Significance

The unmitigated significance is high and mitigated significance is very low.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Rehabilitation	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Demolition Rehabilitation	Maintenance and aftercare of final landforms.

Issue: reduction of catchment runoff and baseline runoff		
Phases: Construction and operational phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very Low
Duration	Medium	Medium
Extent	Medium	Medium
Consequence	Medium	Low
Probability	Very High	Very High

Issue: reduction of catchment runoff and baseline runoff		
Phases: Construction and operational phase		
Significance	High	Medium
Nature of cumulative impacts	Insignificant contribution to cumulative impacts	
Degree to which impact may cause irreplaceable loss of resources	Unlikely with mitigation	
Degree to which impact can be mitigated	Likely with mitigation	
Degree to which impact can be reversed	High	

ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES

There are a number of pollution sources in all project phases that have the potential to pollute surface water, particularly in the unmitigated scenario. In the construction, decommissioning and closure phases these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. The operational phase will present more long-term potential sources. This impact deals with the Construction Phase.

DISCUSSION

Intensity

In the unmitigated scenario, the proposed project presents additional sources of contaminants that has the potential to pollute surface water resources through accidental spills and leaks from trucks. At elevated pollution concentrations these contaminants can be harmful to humans and livestock if ingested. The related unmitigated severity is high. In the mitigated scenario, any dirty surface water run-off from the proposed project areas will be contained within the existing stormwater management infrastructure. Furthermore, the overall objective is to ensure that dirty water is contained and reused rather than discharged into the environment. The mitigated severity is therefore very low.

Duration

In the unmitigated scenario, the potential impacts are long term, occurring for periods longer than the life of mine. With mitigation most impacts can be reversed or mitigated within the life of mine.

Spatial scale / extent

The spatial scale of the potential unmitigated impacts is likely to extend beyond the site area because contamination is mobile once it reaches flowing watercourses. This will be more of an issue in the rainy season when the water courses are all flowing. In the mitigated scenario dirty water run-off will be confined to the site, which is a very low extent.

Consequence

The unmitigated consequence is high and reduces to low with mitigation.

Probability

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

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

The first element is that contamination reaches the surface water resources in and adjacent to the surface use area. With mitigation this is unlikely to occur given that dirty water is contained within the site area. The second element is that third parties and and/or livestock use this contaminated water for drinking purposes. There is a possibility for this to occur, albeit limited, because of the fact that most of the surface water courses only contain surface water in the rainy season which means that livestock are provided with alternative water points. The third element is that the contamination is at a level which is harmful to humans and livestock. This is influenced both by the quality of any discharged effluent and by the diluting effect of any rainwater particularly in the rainy season, which is the season most likely to be associated with some use of the surface water resources. As a combination, the unmitigated probability is high, and the mitigated probability is unlikely.

Significance

The unmitigated significance is high and mitigated significance is very low.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Rehabilitation	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Demolition Rehabilitation	Maintenance and aftercare of final landforms.

Issue: Contamination of surface water resources		
Phases: Construction and operational phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Very Low
Duration	High	High
Extent	Medium	Low
Consequence	High	Low
Probability	High	Very Low
Significance	High	Very Low
Nature of cumulative impacts	Insignificant contribution to cumulative impacts	
Degree to which impact may cause irreplaceable loss of resources	Likely with mitigation	
Degree to which impact can be mitigated	Likely with mitigation	
Degree to which impact can be reversed	High	

MANAGEMENT OBJECTIVE AND OUTCOME

To prevent pollution of surface water resources and related harm to surface water users and to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water

MANAGEMENT ACTIONS

Mitigation by design measures:

- Stormwater management by mainly:
    - The concept of the proposed stormwater management plan is to allow the dirty runoff, within the mine area, to flow across the dirty catchments of the site as surface flow before discharging into lined conveyance infrastructure.
    - Confidence on the minimum risk to the environment is further provided in that the leachate from the proposed WRDs is considered non-hazardous.
    - The WRDs, on the western side of the pit, need to be sloped as much as possible to allow stormwater to flow towards the infrastructure provided.
    - Reuse of stormwater from dirty catchments in the processing plant or for dust suppression.
    - The collection of dirty stormwater and water management strategy defined where the reuse of dirty water will be prioritised, thereby ideally reducing the impacts from the project on the surface water resources through planning for discharge of excess mine water; and
    - Management of silt.

In addition to the measures presented and discussed throughout this report, the following management measures should be implemented:

- Infrastructure design: the design of all onsite access roads, plant areas, stockpiles, WRDs etc. should consider stormwater management and erosion control during both the construction and operational phases.
- Good housekeeping practices should be implemented and maintained by clean-up of accidental spillages, as well as ensuring all dislodged material like run-of-mine stockpile is kept within the confined storage footprints. In addition, clean-up material and materials safety data sheets for chemical and hazardous substances should be kept on site for immediate clean-up of accidental spillages of pollutants.
- Regularly scheduled inspection and maintenance of water management facilities, to include inspection of drainage structures and liners for any in channel erosion or cracks; de-silting of silt traps/sumps and PCDs; and any pumps and pipelines should be maintained according to manufacturer's specifications.
- Vehicles or plant equipment servicing should be undertaken within suitably equipped facilities, either within workshops, or within bunded areas, from which any stormwater is conveyed to a pollution control dam, preferably after passing through an oil and silt interceptor.
- Pollutant Storage – any substances which may potentially pollute surface water should be stored within a suitably sized bunded area and where practicable covered by a roof to prevent contact with rainfall and/or runoff.
- Water Conservation and Water Demand Management (WC/WDM) measures to ensure that as much as is possible, water should be collected and reused, minimising the release of any treated storm flows whilst also reducing the abstraction of water from external and potentially clean water sources (boreholes); and
- From operations onwards, grading of disturbed area and, application of the final layers of growth medium, should be along the contour as far as can be achieved in a safe and practical manner; and vegetation of disturbed areas including seeding should be performed immediately following application of the growth medium to avoid erosion.

All measures implemented for the mitigation of impacts, should be regularly reviewed as best practice and as compliance with various licences issued on site by authorities.

GROUNDWATER

ISSUE: CONTAMINATION OF GROUNDWATER RESOURCES REDUCING AVAILABILITY TO THIRD PARTIES

There are a number of sources in all mine phases that have the potential to pollute groundwater. Some sources are permanent (WRDs) and some sources are transient (starting later and at different time-steps) and becoming permanent (pit backfilling). 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 (waste rock dumps, as the major source term) and the closure phase included in the period of simulation will present final land forms, such as the backfilled open pit may have the potential to pollute water resources through long term seepage and/or run-off.

The rivers in the project area are not expected to be in hydraulic continuity with the main water table (SLR, 2016) and therefore no groundwater related quality impacts are expected on rivers. This impact is therefore not assessed further and the discussion below focusses on potential human health impacts.

DISCUSSION

Intensity

The impact associated with groundwater contamination was assessed as part of the approved EMPr (Metago, 2007). The contaminant transport modelling assumed that responsible housekeeping, management of diffuse pollution sources, and the draw down effect of the open cast pits on any contaminants from the temporary overburden/waste rock dumps, would limit the sources of significant groundwater contamination to the tailings dam facility. Modelling assumed a seepage rate that falls between that of the unlined and lined scenarios for the tailings dam facility. In fact, the tailings dam facility (including the return water dam) will be lined so the model would have over predicted the potential impact. The conservatively predicted impact was that over a thirty-year period, contamination of total dissolved solids at 100 mg/ℓ concentrations would have migrated approximately 700 m from the tailings dam. This impact was rated as being insignificant. It should however be noted that subsequent to this groundwater study, UMK decided not to proceed with the development of the planned tailings dam, and this facility was therefore not constructed.

The mass transport modelling conducted for the project has been completed in a non-reactive mode, which is conservative, and eliminating any diffusion, dispersion, attenuation, etc. The model assumed no barrier systems on the pollution sources. A waste assessment conducted in terms of GNR 635 found that the leachable concentrations did not exceed the defined limit for any of the parameters assessed, and this included manganese. A source term study aimed at predicting the seepage quality form waste rock material predicted the highest concentrations with regard to the parameters sulphate. Therefore, sulphate was modelled.

The maximum possible sulphate source (1621 mg/ ℓ) is assumed to remain in place for the duration of the simulation, on:

- WRDs
- In-pit back filling.

The simulations show that the maximum sulphate plumes developed from the sources extend up to 1.7 km in an eastern direction from the UMK Mine, at the end of the simulation at year 100. Please note that this is SO4 concentration resulting from the WRD/backfill load/deposition, which is added to the general water chemistry. The predicted contamination plume at this maximum extent could impact on boreholes JB9 and 12, RP26, 21 and 40 as well as SP30, with sulphate concentrations of up to 1 631 mg/ℓ. These are however all UMK prospecting and monitoring boreholes. The predicted contamination plume is therefore not expected to impact on third party water users. When considered incrementally this has a low severity in the unmitigated and mitigated scenarios.

Table 2: Max. extent of contaminant plume

Year	Max extent of plume, m
Year 32	893
Year 100	1,700

The cumulative severity rating assessing the impact of the changes to the operation within the context of the approved mining operations is low in the unmitigated scenario because the migration of the pollution plume is not expected to impact on third party water users.

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 area in both the unmitigated and mitigated scenarios.

Consequence

The consequence is moderate 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?
- 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.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There are no known third-party water users located within the predicted contaminant plume.

The third element is whether contamination is at concentrations which are harmful to users. Based on predicted groundwater modelling, mine related contamination could be at relatively high concentrations for a small area to the north of the mining right area.

As a combination, the unmitigated probability is high, and low with mitigation.

Significance

The unmitigated and mitigated scenario significance are medium and low, respectively.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure

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

Issue: Contamination of groundwater resources		
Phases: Operational & Closure phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate	Low
Duration	High	High
Extent	Medium	Medium
Consequence	Medium	Medium
Probability	High	Low
Significance	Medium	Low
Nature of cumulative impacts	Minor contribution to cumulative impacts, impacts would remain within the range previously assessed	
Degree to which impact may cause irreplaceable loss of resources	Low during operational phase, but impact can be minimised if management measures are put in place and followed	
Degree to which impact can be mitigated	Low during operational phase, but impact can be minimised if management measures are put in place and followed	
Degree to which impact can be reversed	Low during operational phase, but impact can be minimised if management measures are put in place and followed	

MANAGEMENT OBJECTIVE AND OUTCOME

To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users

MANAGEMENT ACTIONS

UMK will continue to implement the following management actions:

- UMK will update the hydrocensus to check for any new third-party water uses prior to initiating activities associated with the proposed surface infrastructural changes;
- UMK should continue groundwater monitoring per existing monitoring protocols for the existing monitoring network, taking note of recommendation made in the Groundwater Monitoring Report;
- All potentially affected boreholes will be included in the water monitoring programme for boreholes located both on and off the mine site;
- If any mine related loss of water supply through a reduction in quality is experienced by third party borehole users, UMK will provide compensation which could include an alternative water supply of equivalent water quality;
- Should any off-site contamination be detected, the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures;
- At decommissioning, the potential pollution sources (residual waste rock left on surface) will either be removed or rehabilitated to manage rainfall and seepage; and
- The environmental manager is responsible for implementing these actions from prior to construction through to closure.

AIR QUALITY

ISSUE: DECREASE IN AMBIENT AIR QUALITY

Mining projects present a number of air pollution sources that can have a negative impact on ambient air quality and surrounding land uses in all phases. Pollution sources include land clearing activities, materials handling, wind erosion from stockpiles, wind erosion of disturbed areas, vehicle movement along unpaved roads, dust generation from crushing and screening plants and gas emissions mainly from vehicles and generators. From construction and operation perspective, the proposed project could present additional dust generation sources.

DISCUSSION

Intensity

Dust generated at these sources could have a negative impact on ambient air quality and could result in nuisance impacts as well as health impacts for the nearby receptor, if unmanaged. This is a high intensity in the unmitigated scenario and can be reduced with measures to control dust.

Duration

Without mitigation the duration of the impact could extend beyond closure. However, if the stockpiles, disturbed areas, dust generation from crushing and screening plants are properly rehabilitated and re-vegetated, dust should no longer be generated at these sites. With mitigation, the duration of impact will therefore be limited to construction and operational phases

Spatial scale / extent

The potential impact could extend off site in both the mitigated and unmitigated scenarios.

Consequence

In the unmitigated the consequence is high and reduces to low with mitigation**.**

Probability

Without mitigation the probability is probable. With mitigation, the probability may be reduced with correct management measures.

Significance

The overall significance of this impact is expected to be moderate to low in the unmitigated scenario and can be reduced with mitigation.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Rehabilitation	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Demolition Rehabilitation	Maintenance and aftercare of final landforms.

Issue: Loss of soil resources and land capability through physical disturbance and contamination		
Phases: Construction and operational phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Very High	Low
Extent	Medium	Medium
Consequence	High	Low
Probability	High	Low
Significance	Medium	Low

Issue: Loss of soil resources and land capability through physical disturbance and contamination	
Phases: Construction and operational phase	
Nature of cumulative impacts	Insignificant contribution to cumulative impacts
Degree to which impact may cause irreplaceable loss of resources	Loss where mitigation measures are not correctly implemented
Degree to which impact can be mitigated	High
Degree to which impact can be reversed	Likely with mitigation

MANAGEMENT OBJECTIVE AND OUTCOME

To prevent air pollution health impacts.

MANAGEMENT ACTIONS

Continued Implementation of the following approved mitigation measures in all project phases:

- Exposed areas and unpaved roads – target dust control efficiency of 75% - achieved by applying 0.067 litres of water per meter squared of un-surfaced road or exposed area every hour that is in use by vehicles or equipment. Alternative solutions include paving or the application of chemical binding agents in conjunction with watering. This will be verified by perimeter dust fallout monitoring. Wet suppression and stabilisation (chemical, rock cladding or vegetative) will be applied on stockpiles where feasible;
- Materials handling and crushing and screening – target dust control efficiency of 62% – achieved by water sprays for dust suppression. Alternatively, UMK may use enclosures, dust extraction, bag filters and adding moisture to the ore before handling and processing. Drop height at materials handling activities will be reduced where feasible. This will be verified by visual inspection at all handling points and at the crushers to ensure that there is no plume and perimeter dust fallout monitoring;
- The environmental manager will be responsible for implementing these actions from construction through to closure;
- It is recommended that the manganese content from the road surface material be measured. If the manganese content on the unpaved roads is found to be significant, it is recommended that the impacts be remodelled to quantify their significance; and
- A complaints register should be available at the mine. The date and time noted on the complaints register should be the date and time that the reported problem is observed, note the date and time that the complaint is logged. If used correctly, the complaints register can be compared to monitoring data as well as recorded meteorological data to identify problem areas and to iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources.

NOISE

ISSUES: INCREASE IN DISTURBING NOISE LEVELS

Mining activities and infrastructure have the potential to cause an increase in ambient noise levels that may cause a disturbance to nearby sensitive receptors during all phases prior to closure. The current ambient noise levels at the UMK mine are related to mining activities at UMK Mine (and neighbouring mines), handling and processing of mineral resources, traffic on mine roads. The establishment of additional surface infrastructure and waste rock dumps will not result in significant changes to the noise emission sources within the UMK mine. The impact is therefore **INSIGNIFICANT** in the context of the existing cumulative noise impacts of the mine and will not be assessed further.

VISUAL

ISSUE: ALTERATION OF THE VISUAL ENVIRONMENT AFFECTING SENSE OF PLACE

Mining infrastructure has the potential to alter the landscape character of an area through the establishment of infrastructure. It is however important to note, that the establishment of infrastructure as a result of the proposed surface infrastructural changes will be absorbed by the existing mining infrastructure on site. The establishment of additional surface infrastructure dumps will not result in significant changes to the visual impacts of the UMK mine during construction and operation. The impact is therefore **INSIGNIFICANT** in the context of the existing cumulative impacts of the mine and will not be assessed further.

TRAFFIC

ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

An increase in traffic as well as the use of these roads by heavy vehicles may result in a decrease in road service and safety levels. Traffic impacts are expected from construction through to the end of the decommissioning phase when trucks, buses, and private vehicles make use of the public transport network surrounding the project area. The key potential traffic related impacts are on road capacity and public safety when additional traffic is added to the existing transport network. During the construction, operation, and decommissioning phases of the project there could be a slight increase in traffic from delivery of construction materials, private vehicles making use of the public roads and contractors to the site. The volumes, frequency and duration of construction and decommissioning traffic is likely to be immaterial as compared to the current baseline and any impact would be negligible. This impact has therefore been rated as being **INSIGNIFICANT** and has not been assessed further.

HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

ISSUE: LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

In the event of a chance find where undisturbed areas will be cleared as part of the establishment of additional facilities and activities there is a potential to damage heritage/ cultural and palaeontological resources (if present), either directly or indirectly, and result in the loss of the resource for future generations.

Intensity

The identified heritage resources are of no significance and the intensity of impacts are expected to be very low.

Duration

Impacts to heritage resources is permanent and irreversible and therefore based on the impact assessment methodology it will be a long-term impact in both the unmitigated and mitigated scenarios.

Spatial scale / extent

The extent of the impact is very low as it is limited to a part of the project area.

Consequence

Impacts on heritage resources is expected to be low as the heritage resources are of no cultural significance.

Probability

The heritage resources will possibly be destroyed during the project, although this is a permanent and destructive impact the resources have been recorded in this report and no further mitigation is required, therefore the rating for the probability of impacts on heritage resources is medium.

Significance

The significance of the impacts on heritage resources is low.

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Rehabilitation	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Demolition Rehabilitation	Maintenance and aftercare of final landforms.

Issue: Loss of heritage resources		
Phases: Construction and operational phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low

Issue: Loss of heritage resources		
Phases: Construction and operational phase		
Duration	High	High
Extent	Very Low	Very low
Consequence	Low	Low
Probability	Medium	Medium
Significance	Low	Low
Issue: Loss of palaeontological resources		
Intensity	Low	Very Low
Duration	Very High	Low
Extent	Low	Low
Consequence	Low	Very Low
Probability	Medium	Very Low
Significance	Very Low	Insignificant
Nature of cumulative impacts	Cumulative impacts are low as the recorded heritage features have very low cultural significance	
Degree to which impact may cause irreplaceable loss of resources	Irreversible	
Degree to which impact can be mitigated	Low	
Degree to which impact can be reversed	Impacts to heritage resources are permanent, but due to the low significance of the recorded resources this is not considered an irreplaceable loss to the archaeological record of the area	

MANAGEMENT OBJECTIVE AND OUTCOME

To prevent unacceptable loss of heritage resources and related information.

MANAGEMENT ACTIONS

- Implementation of a chance find procedure for both the archaeological and paleontological resources. If fossils are found once drilling and excavations have commenced, then they should be rescued, and a palaeontologist called to assess and collect a representative sample.
- Excavations through aeolian sands to the calcrete layer especially in the pit should be monitored by an archaeologist or by an environmental Officer (EO) trained by an archaeologist.
- **Monitoring reports of the excavations of the aeolian sands that contain calcrete layers must be submitted to SAHRA upon completion of the construction phase.**
- **If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as**

per section 35(3) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule.

- **If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/ Ngqabutho Madida 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule; See section 51(1) of the NHRA with regards to offences.**
- **If heritage resources are uncovered during the course of the development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.**

SOCIO-ECONOMIC

ISSUE: INWARD MIGRATION AND ECONOMIC IMPACT

In the broadest sense, all mining activities 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.

DISCUSSION

Intensity

The proposed project will allow for the creation of limited short-term employment during the construction phase primarily. During the operation, decommission and closure phases, the proposed project allows for the continuation of the current employment opportunities which will continue to support UMK's contribution to the positive net economic impact on the national, local, and regional economy.

The direct benefits from the proposed project would be derived from limited short-term employment during construction and continuation of the current employment opportunities in all operation, decommission. This is considered to be a negligible and positive severity as the limited job opportunities are not anticipated to result in noticeable change to that of the current situation at the UMK mine. The unmitigated enhanced intensity is likely to be low and would occur over the short-term having an impact on the local area.

Duration

In the normal course, the direct positive and negative economic impacts associated with the mine will occur for the life of mine. Post closure, in the unmitigated scenario, the scale of the impacts will be reduced. Furthermore, the mine would have contributed to income creation, and a better skilled workforce is expected to continue beyond the life of mine.

Spatial scale / extent

In both the mitigated and unmitigated scenarios, the spatial scale of the impact is medium because it will extend beyond the project area on regional scale.

Consequence

In the unmitigated scenario the consequence is a positive low, while it increases to a positive medium to high in the mitigated scenario.

Probability

In the normal course of economic activity, the net positive impacts will seldom occur, while it will increase to possibly occurring with management actions.

Significance

The overall unmitigated enhanced significance is therefore very low (positive). With the implementation of enhancement measures the significance could increase to low (positive).

PROJECT PHASE AND LINK TO PROJECT SPECIFIC ACTIVITIES/INFRASTRUCTURE

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Rehabilitation	Open pit mining Crushing plant Mineralised waste Non-mineralised waste Water supply, use and management Support infrastructure/services Transport system Continued use of approved facilities and services General site management Demolition Rehabilitation	Maintenance and aftercare of final landforms.

Issue: Economic Impact		
Phases: Construction and operational phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low (Positive)	Medium (Positive)
Duration	Medium	Medium
Extent	Medium	Medium
Consequence	Low	Medium
Probability	Low	Medium
Significance	Low (Positive)	Medium (Positive)
Nature of cumulative impacts	Insignificant contribution to cumulative impacts	

Issue: Economic Impact	
Phases: Construction and operational phase	
Degree to which impact may cause irreplaceable loss of resources	Loss where mitigation measures are not correctly implemented
Degree to which impact can be mitigated	High
Degree to which impact can be reversed	Likely with mitigation

MANAGEMENT OBJECTIVE AND OUTCOME

To enhance the positive economic impacts and limit the negative economic impacts.

MANAGEMENT ACTIONS

Management actions that have been identified for all project phases include the following:

- Clear communication that employment of exclusively local people for the proposed project cannot be guaranteed but that where possible the employment opportunities will go to local people;
- Effective and timeous communication with community leaders who can attest to a fair and transparent process amongst the community rather than challenging the mine on the community's behalf over jobs and recruitment;
- The precise number of job opportunities (permanent and temporary) will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated, and employees provided with regular reminders and revisions throughout the employment period;
- The existence and screening of specific skills will be determined through the establishment of a skills register prior to employee selection processes;
- Good communication with all job seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved;
- Urging people to get all their documents and certificates, including valid driving licenses, in order prior to recruitment;
- Notifying unsuccessful job seekers once the recruitment process is complete;
- Where possible, hire local people from the closest communities;
- Where possible, ensure it procures local goods and services from the closest communities;
- Implement a procurement mentorship programme which provides support to local businesses from the enquiry to project delivery stages;
- Include the incorporation of economic considerations into its closure planning from the outset;
- Closure planning considerations cover the skilling of employees for the downscaling, early closure and long-term closure scenarios; and
- Identify and develop sustainable business opportunities and skills, independent from the project for members of the local communities to ensure continued economic prosperity beyond the life of project.

ISSUE: INWARD MIGRATION

Mines tend to bring with them an expectation of employment in all proposed project phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. The proposed project is located within an existing mining operation and will result in limited short-term employment opportunities during construction, therefore negative project-related socio-economic impacts including inward migration, which could place additional pressure on housing and municipal services, are not expected to occur. This impact has therefore been rated as being **INSIGNIFICANT** and has not been assessed further.

LAND USE

ISSUE: CHANGE IN LAND USE

Mining and project related activities and infrastructure may have an impact on land uses within and surrounding the project area in all phases. Land use within UMK Mine includes existing mining activities and associated infrastructure. The surrounding land uses includes mining operations, agriculture, isolated farmsteads, infrastructure, and solar plant. Given that the land use within the proposed project is limited to mining as a result of the existing mining operations, the proposed project will not result in changes to the current land use. This impact has therefore been rated as being **INSIGNIFICANT** and has not been assessed further.