DRAFT INTEGRATED ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED LEIDEN COAL MINE

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ABBREVIATIONS

ABET	:	Adult Basic Education and Training
APPA:		Atmospheric Pollution Prevention Act
AEL	:	Air Emissions Licence
AMD	:	Acid Mine Drainage
BEE	:	Black Economic Empowerment
CCL	:	Continental Coal Limited
DEA	:	Department of Environmental Affairs
DMR	:	Department of Mineral Resources
DWA	:	Department of Water Affairs (formerly DWAF)
DWAF	:	Department of Water Affairs and Forestry
EA	:	Environmental Authorisation
EAP	:	Environmental Assessment Practitioner
ECA	:	Environmental Conservation Act
EI	:	Ecological Importance
EIA	:	Environmental Impact Assessment
EIMS	:	Environmental Impact Management Systems (Pty) Ltd.
EMP	:	Environmental Management Plan
EMPR	:	Environmental Management Program
EMS	:	Environmental Management System
ES	:	Ecological Sensitivity
FRAI	:	Fish Response Assessment Index
GDP	:	Gross Domestic Product
GSDM	:	Gert Sibande District Municipality
HIA	:	Heritage Impact Assessment
HSDA	:	Historically Disadvantaged South Africans
I&AP	:	Interested and Affected Party
IHI	:	Index of Habitat Integrity
IRR	:	Issues and Response Report

ISO : International Organisation for Standardisation

IWULA : Integrated Water Use License Application

IWWMP: Integrated Water and Waste Management Plan

LSU : Livestock Unit

LOM : Life of Mine

MDEDET: Mpumalanga Department of Economic Development and Tourism

MLM : Mkhondo Local Municipality

MPRDA: Mineral and Petroleum Resources Development Act

NEMA : National Environmental Management Act

NEMAQA: National Environmental Management: Air Quality Act

NEMBA: National Environmental Management: Biodiversity Act

NEMWA: National Environmental Management: Waste Act

NOMRA: New Order Mining Right Application

NHRA : National Heritage Resources Act

NWA : National Water Act

PCD : Pollution Control Dam

PES : Present Ecological Status

POI : Points of Interest

PM_{10} : Particulate Matter with an aerodynamic diameter of less than 10μm

$PM_{2.5}$ " Particulate Matter with an aerodynamic diameter of less than 2.5μm

PPP : Public Participation Process

ROM : Run of Mine

SAS : South African Scoring System

SHE : Safety, Health and Environmental

SHI : Site Habitat Integrity

SLP : Social and Labour Plan

TIA : Traffic Impact Assessment

WML : Waste Management License

EXECUTIVE SUMMARY

INTRODUCTION

Mashala Resources (Pty) Ltd (hereafter referred to as the Applicant) compiled and submitted a NOMRA in terms of the MPRDA for the proposed Leiden Coal Mine in 2013. The application was subsequently accepted by the DMR on 14th April 2014. In addition, an application for authorisation of listed activities under the NEMA and NEMWA was submitted to DEA and MDEDET respectively and the applications were subsequently accepted by both DEA and MDEDET. As required by the above mentioned legislation, the acceptance of these applications required the applicant to undertake a full Scoping, EIA and EMP. This report represents an Integrated Environmental Management Programme (IEMPR). As an IEMPR, the report has been designed to meet the requirements for conducting an Environmental Impact assessment (EIA) and Environmental Management Programme (EMPR) as stipulated in the Regulations contained in both the Mineral and Petroleum Resources Development Act (MPRDA, Act No. 28 of 2002) and the National Environmental Management Act (NEMA, Act No. 107 of 1998) respectively.

The proposed Leiden Coal Mine is located on Portion RE (Remaining Extent) of the farm Leiden 340 IT. The area under application is approximately 1 291.75 ha and falls within the jurisdiction of the Mkhondo Local Municipality in the Gert Sibande District Municipality of the Mpumalanga Province approximately 58km southeast of the town Ermelo and 61km northwest of Piet Retief. The proposed Leiden Coal mine will ideally employ a combination of open-cast and underground mining methods. The operation is aimed at mining coal seams from a reserve of approximately 2 199 404 saleable tonnes of coal from a depth of between 15-55 m which is located in the Vryheid Formation of the Karoo Supergroup. The anticipated Life of Mine (LoM) is 10 years but can be further extended if deeper reserves are to be exploited at a later stage. As such, the proposed Leiden Coal Mine will target a Run of Mine (RoM) production rate of 18 000 tonnes per month. The majority of the coal will be export quality thermal coal. All RoM from the proposed Leiden Coal Mine will be transported via truck to the Delta Processing and Dispatch Centre (Delta) in Ermelo where all mineral processing and mineralised waste disposal will take place.

BASELINE RECEIVING ENVIRONMENT

GEOLOGY

The proposed Leiden Coal Mine is situated within the Ermelo Coalfield, the seams which occur on the property have been logged as the Ulrecht Coalfield seams of the Gus and Dundas seams. The Gus seam lies stratigraphically above the Dundas seam with a parting of approximately 15 m. The Gus seam occurs at a depth of approximately 30 m from surface with an average width of 0.70 m, whilst the Dundas seam occurs at a depth of 45 m from surface with an average width of 1.45 m. Faults and dolerites occur with the project area. Dolerite was intersected in 8 boreholes drilled during prospecting. The local dip is typically around 2° to 4° within a local synclinal structure with a central axis striking southwest to northeast.

TOPOGRAPHY

The study area lies between 1 450 and 1 600 m above sea level, with the highest point on the western boundary. The terrain falls gently to the east, with slopes of between 2% and 5% and is generally undulating throughout. The area is drained by tributaries of the Ngwempisi and Hlelo Rivers, which flow generally from west to east.

CLIMATE

The climate of the study area is typical of the South African Highveld with warm summers and cold winters. The rainfall associated with the Mpumalanga region is deemed Mediterranean. The majority of the annual average rainfall of 748 mm falls in summer (October to April). The extreme maximum temperature is 24.6^{o}C and the extreme minimum temperature is 0^{o}C. Fog occurs for an average of 20 days a year, generally in the winter.

SOILS

The soils of the application area vary slightly from sandy loam to sandy clay loam and the effective depth also varies somewhat, generally between 600 mm and 1200 mm. Small areas of the study area are dominated by shallow soils and a few surface outcrops. The prevailing agricultural potential of the area is moderate to high. The majority of the soils on site have an average effective soil depth of 800 mm or more which is more than adequate for agricultural activities.

LAND USE

The proposed area under application lies immediately to the east of the south-eastern Mpumalanga escarpment. To the west, above the escarpment, the dominant land use is grazing land, with occasional areas of dry land cultivation. Below the escarpment are more favourable soils where commercial forestry plantations take place, extending to the east and north-east. Forestry plantations occur in most of the higher-lying parts of the study area. Closer to the stream beds, and especially in the wider valley floors in the north and south of the study area, grassland (either natural or cultivated pastures) occur, presumably because the soils are too wet for sustainable tree growth. As a land use, forestry plantations dominate the site.

LAND CAPABILITY

The pre-mining land capability identifies the soils as falling into the arable class, due to their favourable depth, texture and natural drainage. Virtually the whole application area (all the non-wetland areas) can be classed as arable, despite the fact that forestry is the prevalent land use. The grazing capability by livestock is predicted to be high with an average of between 6-8 ha per large stock unit.

SOCIAL

Generally the communities in the area surrounding Leiden 340 IT are poorer than other communities situated in the Mpumalanga Province. This may be attributed to the lower levels of employment and poor infrastructure. Although the area is dominated by agriculture and forestry, jobs are generally only selectively available seasonally for unskilled labourers. The prominent language of the area is SiSwati, which is widely spoken throughout the community. Other dominant languages are IsiZulu, Xitsonga, IsiNdebele, and Sepedi. Education in the area is poor as a result of the lack of schools available.

ECONOMIC

The Mpumalanga economy benefits from the strong demand for energy provided by coal fired power stations. In addition, the major industry sectors in the Mpumalanga economy, mining and manufacturing, are likely to exhibit sustainable economic growth in the future. This emphasises the strong economic need for coal resources for energy production. It is also noted that the Mkhondo Local Municipality is in great need of business investment and job creation due to a reduction in employment levels over the last decade due to the downscaling of forestry operations. As such, the proposed Leiden Coal Mine will likely fit in with the overall provincial economic structure, especially in terms of employment and industry sector growth.

FAUNA

The wetlands and drainage lines, ridges, and intact patches of connected grassland; irrespective of their ecological condition, represent the most sensitive faunal habitats present within the application area despite the vast transformation by forestry operations. As such, significant habitat still remains for faunal species. There are a number of animal species of conservation concern that may occur in habitats within the study area. No mammalian or amphibian species of concern are likely to occur within the application area. In terms of reptilian species, two species of concern are likely to occur on site and include the Striped Harlequin Snake and Yellow-bellied House Snake, both of which are listed as Near Threatened. Twelve bird species of concern were identified that are likely to potentially occur on site and include Blue Crane, Grass Owl, Short-tailed Pipit, Southern Bald Ibis, Striped Flufftail, Denham's Bustard, Yellow-breasted Pipit, Blackwinged Lapwing, Blue Korhaan, Crowned Eagle, Lanner Falcon, and Secretary bird. All bird species identified are classified as either Vulnerable or Near Threatened.

FLORA

The majority of the study area falls within the Eastern Highveld Grassland vegetation type, which is classified as Endangered by Mucina and Rutherford (2006) and as Vulnerable in the NEMBA list (2011). The south-west corner of the site falls within the Wakkerstroom Montane Grassland vegetation type, which is classified as Least Threatened, although very little of it is formally protected (Mucina & Rutherford 2006). Several threatened species were recorded in the area but only one species, *Eucomis autumnalis*, may potentially occur close to the proposed mining activities in the temporary zone of the wetland. The habitat is however not ideal for the species. A few species protected under the Mpumalanga Nature Conservation Act, mostly bulbous species, were observed on site and a permit is required to remove or move these species on site. In addition, several invasive species listed under Conservation of Agricultural Resources Act (CARA, 1983) and the Mpumalanga Nature Conservation Act were observed on site. According to the Mpumalanga C-Plan most of the site has no natural habitat remaining. The rest of the site is located in areas indicated to be Least Concern or Important and Necessary. The Highly Significant and Important and Necessary habitats are mostly located in the portion of primary vegetation and wetland vegetation remaining within the study area. There are therefore a few portions of vegetation on site that are important for protection of the biodiversity of Mpumalanga

WETLANDS

Wetland cover within the application area is more than 18%. Three wetland types namely, hillslope seepage wetlands, channelled valley bottom wetlands, and unchannelled valley bottom wetlands occur on site, with hillslope seepage wetlands being the dominant wetland type. A discharge point of a catchment transfer scheme also occurs on site. Although the wetlands have been exposed to frequent impacts associated with agricultural activities, the wetland types and wetland vegetation type occurring on site are indicated as being Critically Endangered, indicating that significant loss of these wetlands has occurred within the area, elevating the importance of the remaining wetlands.

AQUATIC ECOLOGY

Most of the reaches of concern are of moderate ecological importance according to the DWA study. The exceptions are the Hlelo tributaries (W52A-1934) which are classified as being of high ecological importance. All reaches of concern are classified as being of high ecological sensitivity. The overall Present Ecological State (PES) was considered Pristine (Category A) to Largely Natural (Category B) within the Hlelo tributaries. Within the Ngwempisi River, habitat integrity was relatively good (Category B, Largely Natural) upstream of the site but deteriorated sharply downstream of the interbasin transfer (from Heyshope Dam) discharge point. The downstream site was considered moderately to Largely Modified (Category C to D) in terms of habitats. The Hlelo tributaries were considered Pristine to Moderately Modified (Category A-B) for aquatic macroinvertebrates. Within the Ngwempisi River, there was a significant decrease in diversity evident between the upstream and downstream Ngwempisi sites as a result of the loss of habitats due to increased flows from the inter-basin transfer. The Ngwempisi River was classified as Moderately Modified (Category C) at its downstream site. However, sensitive taxa were still present indicating that that the decline in PES was mainly due to habitat loss and not water quality deterioration. In terms of the overall aquatic diversity assessment, the southern catchment (W52A), which covers roughly two thirds of the study area, is considered “Highly Significant”; while the northern sub-catchment (W53A) is termed to be important for “Ecosystem Maintenance”.

SURFACE WATER

The proposed Leiden Coal Mine is located within the W52 and W53 quaternary catchments (Mfolozi/Pongola catchment). The catchments of the upper reaches of the Ngwempisi River (W53A), to the north and Hlelo River (W52A) to the south, are moderately disturbed. A large inter-basin water transfer scheme releases some 45 million cubic meters of raw water into the Ngwempisi River. This water flows down the slightly modified watercourse of the Ngwempisi River, through the northern section of the area under application. Both quaternary catchments fall within the W50 (Usuthu River Basin) drainage area, which constitutes an internationally shared basin and will be subject to existing treaties that govern releases and water quality at the Swaziland border. The water requirements of Swaziland are an important factor in this catchment, and it is accepted that 50% of natural base-flow for the rivers should be available at the downstream border of Swaziland, and that water should at least meet South African SANS standards for irrigation water. Base-line water quality analyses indicate that the surface water quality is reasonably good. The watercourses within the application area have been identified as highly sensitive areas. The results of the assessment show that the predicted water level of the watercourse is not approaching the boundary of the proposed mining area during a 1:100 year flood event. However the proposed underground area will intersect with several water courses and is therefore partially located in a highly sensitive area.

GEOHYDROLOGY

The area under application displays two main aquifers namely, a shallow weathered aquifer and a deeper fractured aquifer. The shallow weathered aquifer is typically low yielding and is generally not used for water supply. The deeper fractured rock aquifer, is typically found between 20 and 50 m bgl, and shows typical blow yields ranging between 0.5 and 3 l/s on average, with exceptions between 5 and 10 l/s found at dolerite intrusion contacts and fault zones. The hydrocensus conducted included nine boreholes, three springs and three groundwater seepage features. It was found that the majority of these boreholes are used for domestic water supply and livestock watering with the two other boreholes being used as monitoring points and two that had been abandoned and are no longer in use. The water levels found varied between 3 – 20 m below ground level (bgl), these depths are indicative of the afore mentioned aquifers. Water quality results indicated that groundwater quality is generally good across much of the area, however there is evidence of localised groundwater contamination which is possibly linked to historical mining activities.

AIR QUALITY

The baseline air quality for the region is unknown, with no ambient measurements available for any of the relevant particulates. It is assumed that the air quality is relatively good as there are no numerous major sources of pollution located near the site. However, power generation, mining activities, farming and residential land-uses occur in the greater area surrounding the proposed Leiden Coal Mine project. These land-uses contribute baseline emission sources via vehicle tailpipe emissions, household fuel combustion, biomass burning and various fugitive dust sources. The largest contributor to particulate emissions is as a result of vehicle entrainment on unpaved roads, windblown dust from exposed areas, and biomass burning

NOISE

The area under application can be described in general, as quiet. Dominant source of noise is natural and induced by wind and birds. Measured data indicate sound levels typical of an area with a rural district sound character with wind and agricultural activities raising the sound levels. The measured $L_{Aeq,f}$ levels during the day and night however conforms to the recommendation of 55 and 45 dBA respectively by the World Health Organization, World Bank and International Finance Corporation for residential use.

CULTURAL AND HERITAGE RESOURCES

The area under application is host to a total of nine heritage sites comprising of six cemeteries, one historic farmstead, one historic farm worker dwelling and one historic rock engraving. However, large sections of the proposed development area (within the area under application) had been disturbed by the establishment of plantations. Despite an intensive walkthrough of the development footprint, no heritage sites were identified. The closest heritage site, a historic homestead is located approximately 1.3 km from the proposed development footprint. As such, no heritage sites occur within or in near proximity of the development footprint, other than the remote potential presence of stillborn babies which could potentially be buried near or under homesteads. In addition, it is unlikely that any fossils will be observed before the mining takes place

VISUAL

The study area has a placid and peaceful pastoral sense of place with the farmsteads and residences, schools and church introducing a rural component to the sense of place. The placid and peaceful sense of place is derived from the mountain back drop and undulating topography covered in plantations, crops and grassland vegetation. Grazing and other agricultural activities introduce the pastoral element. The south eastern half of the area under application is considered to be more sensitive than the north western half, with the north western corner being the least sensitive area of the site.

TRAFFIC

The proposed site will be accessed via either Gravel Road 1 or Gravel Road 2, both of which link from the N2. Both access roads are local gravel roads providing access mainly for forestry activities. Both access roads will be difficult to negotiate during the wet seasons of the year and regular maintenance would be required in terms low water bridge crossings and dust control. However Gravel Road 1 will be difficult to negotiate even in dry weather and has several water crossings. Gravel Road 2 is already utilised by forestry trucks which indicates that the road is designed to handle heavy loads. The traffic volumes on the gravel roads are mainly the result of traffic from the local plantations in the area to the Busby Saw Mill and Panbult railway station, with less than ten vehicles per hour in both directions during the morning and afternoon peak hours. The traffic generated by the proposed Leiden Coal Mine will be distributed along the existing road network and sufficient capacity exists on the road network to accommodate the proposed development traffic volumes. The nearest rail network is located east of the N2 Road with stations at Sheepmoor and Panbult. This rail network is the main rail link between Gauteng and the Richards bay export harbour and is mainly used for the export of coal. The line feeds large volumes of bulk traffic between Gauteng and Richards bay.

PROJECT DESCRIPTION

The proposed Leiden Coal mine will ideally employ a combination of open-cast and underground mining methods. The operation is aimed at mining coal seams from a reserve of approximately 2 199 404 saleable tonnes of coal from a depth of between 15-55 m which is located in the Vryheid Formation of the Karoo Supergroup. The anticipated Life of Mine (LoM) is 10 years but may be further extended if deeper reserves are to be exploited at a later stage. As such, the proposed Leiden Coal Mine will target a Run of Mine (RoM) production rate of 18 000 tonnes per month. The majority of the coal will be export quality thermal coal. All RoM from the proposed Leiden Coal Mine will be transported via truck to the Delta Processing and Dispatch Centre (Delta) in Ermelo where all mineral processing and mineralised waste disposal will take place. The proposed Leiden Coal Mine will only utilise a small, mobile onsite crusher for initial minerals processing. The crusher will be used to crush and screen RoM to a manageable size prior to it being stockpiled. Crushed and stockpiled RoM will then be transported by conventional load and haul operations to the offsite Delta Plant in Ermelo for further mineral processing. Other than primary crushing and screening, no further mineral processing will take place at the project site. All further RoM processing and final mineralised waste disposal will take place at Delta Plant, includes coal discards. Due to all mineral processing and mineralised waste disposal occurring at the Delta Plant in Ermelo, the proposed Leiden Coal Mine requires limited infrastructure in order to operate. As such, the infrastructure required is listed below:

ALTERNATIVES

Three development alternatives for the proposed Leiden Coal Mine are identified and comparatively namely:

- Alternative 1: No-Go;
- Alternative 2: Maximum Mine Production; and
- Alternative 3: Sensitivity Planning Approach

Alternative 1 implies that no mine development takes place and that the environment remains unchanged and unaltered. At present, the proposed development site for the Leiden Coal Mine is comprised of a mixture of "undisturbed" natural vegetation and extensive forestry plantation. The No-Go Alternative will entail the continuation of the current land uses on site which are comprised of commercial forestry plantations, sawmill operations, cattle grazing, old field, wilderness and tracts of vacant land.

Alternative 2 emphasises the mining and production of coal. Less restrictive mitigation measures will be utilised to protect environmental features, thus allowing for the maximum production of coal through the use of both underground and extensive open-cast mining methods. This alternative will increase the financial viability of the proposed Leiden Coal Mine at the potential cost of impacting on more environmental features over temporal and spatial scales.

Alternative 3 emphasises resource (bio-physical and socio-economic) protection and utilises specialist planning to identify areas of consolidated environmental sensitivity to assist with mine design and layout. Included in this alternative is the assessment of mining method (open-cast vs underground) as well as infrastructure placement. As such, Alternative 3: Sensitivity Planning Approach includes the reduction of the open-cast to an initial box cut entrance to the decline shaft in favour of underground mining only. In addition the design and placement of infrastructure in areas of overall low environmental sensitivity as delineated by the consolidated sensitivity mapping is also undertaken.

Based on the assessment undertaken, it is the opinion of the EAP (which is supported by the various specialists assigned to the project) that Alternative 3: Sensitivity Planning Approach is the most preferred development alternative for the proposed Leiden Coal Mine.

SPECIALIST STUDIES

The compilation of the EIA and EMP for the proposed Leiden Coal Mine required the input and contribution from several specialists namely:

- Air quality;
- Blasting and vibration;

- Closure costing, rehabilitation and final land use;
- Ecology (Fauna and Flora);
- Heritage;
- Hydrology (Ground and Surface water);
- Noise;
- Socio-Economic;
- Soils, land use and land capability;
- Traffic;
- Visual; and
- Wetlands and aquatic ecology.

The specialist studies undertaken assisted in the determination of the baseline receiving environment, the identification of site specific sensitivities, assessment of impacts for all project phases and the provision of suitable technical management/mitigation measures to be implemented.

SIGNIFICANT IMPACTS IDENTIFIED AND ASSESSED

As a result of the impact assessment a detailed list of significant impacts is provided below and for each project phase. The selection criteria for impacts deemed “significant” is simply the final score calculated post mitigation and with the addition of the prioritisation factors described in the assessment methodology, which includes cumulative impacts, loss of irreplaceable resources and I&AP comment or concern. The list below includes significant positive and negative impacts during each project phase.

SIGNIFICANT PRE-CONSTRUCTION PHASE IMPACTS

- Social expectations;
- Social licence to operate (positive); and
- Employment addition to economy (positive)

SIGNIFICANT CONSTRUCTION PHASE IMPACTS

- Health impacts;
- Social vices;
- Crime and violence;
- Employment addition to economy (positive);
- Acid Mine Drainage;
- Acid mine drainage effects on surrounding ecosystems;
- Erosion at river crossings (haul roads) ;
- Clearing topsoil for footprint areas; and
- Ground water quality

SIGNIFICANT OPERATION PHASE IMPACTS

- Dust from a nuisance and livelihood perspective;
- Impacts associated with the transport of workers;
- Blasting and vibration from a social perspective;
- Crime and violence;
- Economic impacts (positive);
- Relocations;
- Annual GDP (positive) ;
- AMD;
- AMD effects on surrounding ecosystems;
- Acids downstreams effects;
- Acids effects on water chemistry;
- Chemical precipitates;
- Acid management measures;
- Environmental liability;
- Poor acid conditions;
- Acidification of surface water;
- Water quality impacts due to spills/leaks and stormwater;
- Water impacts due to runoff and erosion;
- Water impacts due to major spills (fuel and sewage);
- Flow modification (subsidence and open cast mining);
- Loss of sensitive species and decline in biodiversity ;
- Cumulative impacts;
- Dewatering;
- Reduction in streamwater baseflow;
- Ground water quality; and
- Nuisance dust fall

SIGNIFICANT DECOMMISSIONING PHASE IMPACTS

- Loss of jobs and economic opportunities;
- Re instatement of livelihoods (positive);
- Decrease in GDP;
- AMD;
- Acids downstreams effects;
- Acids effects on water chemistry;
- Chemical precipitates;
- Acid management measures;
- Environmental liability;

- Poor acid conditions;
- Erosion;
- Water quality (seepage and AMD);
- Water quality deterioration related to spills/leaks;
- Loss of sensitive species and decline in biodiversity;
- Ground water contamination plume;
- Contaminated groundwater seepage to streams (salt load); and
- Decant from underground water

SIGNIFICANT REHABILITATION AND CLOSURE PHASE IMPACTS

- Social expectations;
- Social licence to operate (positive);
- AMD;
- AMD effects on surrounding ecosystems;
- Acids downstreams effects;
- Acids effects on water chemistry;
- Chemical precipitates;
- Acid management measures;
- Environmental liability;
- Poor acid conditions;
- Water quality – decant and AMD;
- Decrease in water quality due to Ingress;
- Biodiversity losses and decline in biotic integrity;
- Cumulative impacts;
- Ground water contamination plume;
- Contaminated groundwater seepage to streams (salt load); and
- Decant from underground water

SIGNIFICANT RESIDUAL IMPACTS POST CLOSURE

- AMD; and
- Decant

PUBLIC PARTICIPATION

The PPP for the proposed Leiden project has been undertaken in accordance with the requirements of the MPRDA, NEMA, and NWA, in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&AP's are afforded an opportunity to comment on the project.

Initial identification of I&AP's was undertaken utilising Windeed searches to determine the registered landowner of the area under application and registered landowners within the surrounding area. From this initial list of I&AP's the database was expanded to include other I&AP's which were then separated into four broad categories:

- Registered landowners and lawful occupiers of properties under application;
- Registered landowners of surrounding properties and key individuals;
- Authorities and government departments; and
- Organisations, agencies, groups, unions and companies.

On completion of the NEMA Scoping and EIA Application form, and receipt of the corresponding reference numbers from the National Department of Environmental Affairs (DEA), Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) and DMR the Integrated PPP was initiated on 25 April 2014. Notification documents were drafted and sent via registered post, facsimile, and e-mail on 25 April 2014. The notification documents included a Background Information Document (BID) providing all the relevant information for the project and explained the mechanism by which I&AP's can register for the project. Two advertisements were placed in newspapers with adequate circulation in the area. The advertisements were placed in the Beeld on 24 April 2014 and in the Highveld Tribune on 29 April 2014. Site notices were placed along and within the perimeter of the proposed project area on 24 April 2014.

Two Public Open Days will also be scheduled. The first Public Open Day was held on 19 June 2014 at the Ermelo Country Club and was aimed at introducing I&AP's to the proposed project, explaining the process going forward and providing them opportunity to comment on the Draft Scoping Report. The main issues that were raised were the following; a) In terms of job opportunities, when will the mine be scheduled to commence, b) Has there been interest in the mine with I&AP's commenting on the project, c) Are there any homes located within the zone of influence with respect to the blasting and vibration that is to commence, d) Where is the mine located and e) The landowners are satisfied with the information that has been provided for the project and inquired as to what EIMS's opinion was regarding the granting of the mining right.

The second Public Open Day will be held to discuss the findings of the EIA investigation and to solicit further comment, concerns, suggestions or objections from I&AP's for inclusion into the document. I&AP's will also be provided a period in which to comment on the Draft EMPR Report prior to submission. The second Public Open Day is scheduled for 15 October 2014 also at the Ermelo Country Club. Information obtained from the open day will be included into the updated IEMPR and submitted to the Authorities for adjudication. Throughout the project, any and all I&AP's who have expressed interest in the project or have been identified through the dissemination of notification documents have been captured and added to the database for the proposed Paardeplaats Coal Mine.

FINANCIAL PROVISIONS

The calculation of the Financial Provision for the proposed Leiden Coal Mine is based on development Alternative 3, namely the Sensitivity Planning Approach. The calculation utilised the master rates provided by the DMR which have been adjusted to include CPI rates for 2014. As such, the Financial Provision amounts to a net total of R 117 214 297. In addition, the DMR “Guideline Document for the Evaluation of the Quantum of Closure-Related Financial provision provided by a Mine”, requires the following inclusions for the purposes of calculating the total mine closure liability.

- Preliminary & General, contractor site establishment -12% (subtotal R 14 065 716)
- Contingency – 10% (subtotal R 11 721 430)
- VAT – 14% (subtotal R 16 410 001)

This would result in a Clean Cost Closure Liability of R 117 214 297 and a Total Mine Closure Liability (incl. P&G, Contingency and VAT) of **R 159 411 444.** Provision is included for the annual update of the Financial Provisions**.**

CONCLUSION

The proposed Leiden Coal Mine is located in the Mkhondo Local Municipality which is in great need of business investment and job creation. The commencement of the proposed Leiden Coal Mine will likely contribute to both business investment and job creation as well as improve business confidence in the area. As such, the project fits in well with the overall provincial economic structure, most notably in terms of employment and industry sector growth.

Despite the economic benefit of the proposed Leiden Coal Mine, the project is likely to result in several significant environmental impacts that will require ongoing management. In order to best manage these impacts it is the opinion of the EAP (which is supported by the various specialist consultants) that the most preferred development alternative is Alternative 3: Sensitivity Planning Approach.

Approval of Alternative 3 allows for both resource protection through the restriction of the operation to underground mining only and reduces the extent of impacts across the temporal and spatial scales. Furthermore it allows for the opportunity to undertake a mixed land use on the property whereby forestry operations, with certain restrictions, can continue on the surface and coal mining underground.

SECTION 1: ENVIRONMENTAL IMPACT ASSESSMENT

1 INTRODUCTION

This report represents and Integrated Environmental Management Programme (IEMPR). As an IEMPR, the report has been designed to meet the requirements for conducting an Environmental Impact assessment (EIA) and Environmental Management Programme (EMPR) as stipulated in the Regulations contained in both the Mineral and Petroleum Resources Development Act (MPRDA, Act No. 28 of 2002) and the National Environmental Management Act (NEMA, Act No. 107 of 1998) respectively.

This IEMPR is submitted in support of the Mining Right application submitted by Mashala Resources (Pty) Ltd; a wholly owned subsidiary of Continental Coal (Pty) Ltd for the proposed Leiden Coal Mine, located between the towns of Ermelo and Piet Retief in the Mpumalanga Province.

The project area is situated in the Ermelo coalfield, although the coal seams which occur on the property have been logged as the Utrecht Coalfield seams of Gus and Dundas seams. According to historical exploration records, a total of 187 000t (in situ) was mined from the Dundas seam more than 10 years ago by Kangra Coal (Pty) Ltd. Mashala was granted a Prospecting Right (710/2006 PR) for Leiden on the 17th October 2006 and the Prospecting Right has subsequently been renewed twice.

In order to comply with National Legislation the proposed Leiden coal mine will require authorisation in terms of the MPRDA, NEMA, NEMWA, and NWA. This application for authorisation for the Leiden Coal Mine falls under the Integrated Environmental Approach. Thus, in parallel to the application in terms of the MPRDA, an application in terms of NEMA and NEMWA, and an application in terms the NWA must be compiled and submitted to the relevant Government Authorities for decision-making.

The NOMRA was submitted to DMR and was subsequently accepted on 14th April 2014. An application for authorisation of listed activities under the NEMA and NEMWA was submitted to DEA and MDEDET and the application was subsequently accepted by both DEA and MDEDET.

The Scoping Report has been submitted to the DMR, MDEDET, and DEA for review and I&AP's were notified and provided 45 days to review and comment on the Draft Scoping Report. A public Open Day was held on the 19th June 2014 to present the results of the scoping phase assessment to the public. Following the public open day on 19 June 2014, the Final Scoping Report (inclusive of I&AP comment) was submitted to the MDEDET and DEA on 10th July 2014.

This draft EMPR has been submitted to the MDEDET and DEA for review and IAP's were notified on 12th of September 2014 of the 45 day review and commenting period. A second public Open Day has been scheduled for the 15th of October 2014 to present the results of the EIA phase assessment to the public. All comment received during this commenting period will be included in the final EMPR to be submitted to the DMR, MDEDET, and DEA by the 3rd of November 2014 for decision making purposes.

1.1 PROJECT BACKGROUND

Mashala Resources (Pty) Ltd (hereafter referred to as Mashala) compiled and submitted a New Order Mining Right Application (NOMRA) in terms of the MPRDA for the proposed Leiden Coal Mine in 2013. The application was subsequently accepted on 14 April 2014. As required by the MPRDA, the acceptance of the application required the applicant to undertake a full Scoping, EIA and EMP in support of the application.

To this end Mashala submitted a Draft Scoping Report to the Department of Environmental Affairs (DEA) on the 25th of April 2014 and the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) on 24th of April 2014. The Public Participation Process was initiated on the 25th of April 2014 and included the identification and notification of all Interested and Affected Parties (I&AP's), notice of the first Public Open Day and notice that the Draft Scoping Report was available for review. I&AP's were afforded 45 days (from 25th April 2014 to 12th June 2014) to register, review the Draft Scoping Report and submit comment for inclusion into the Integrated Scoping Report to be simultaneously submitted to both DMR and MDEDET.

The first Public Participation Open Day was held on 19th June 2014 at the Ermelo Golf Club from 09:00 to 16:00. The purpose of the open day was to introduce I&AP's to the project and solicit opinion on the Draft Scoping Report and comment for inclusion in the IEMPR.

The final Integrated Scoping Report was completed, with input from I&AP's and submitted to the DMR on the 2nd June 2014 at their regional offices in Witbank. Copies of the report were also sent through to the DEA, DEDET, and Department of Water Affairs (DWA) Lydenburg for review.

This document is the Draft Integrated Environmental Management Programme (EMPR) due for submission on 3rd of November 2014 to the DMR,DEA and MDEDET. I&AP's who have registered for the project will be notified that the document is available for review and informed of the second Public Participation Open Day to be held on 15th of October 2014 at the Ermelo Golf Club discuss the results of the EIA. I&AP's will be provided until 29th of October 2014 to review the report and provide comment for inclusion into the final Integrated Environmental Management Programme to be submitted to the DMR, DEA, and MDEDET on the 3rd of November 2014.

1.2 BRIEF PROJECT DESCRIPTION

This section provides a brief overview of the proposed Leiden project. Please refer to section 4 of this report for a detailed project description.

The proposed project area is situated on the Remaining Extent (RE) of the farm Leiden 340 IT and covers an area of 1 291.75 ha. The proposed Leiden Coal Mine will comprise of bord and pillar underground mining with a small area of rollover open cast mining at the adit. The proposed Leiden Coal Mine will aim to produce up to a planned monthly production rate of 35 000 tpm (for a period of approximately 18 months) for the opencast mining, and up to 25 000 tpm from the underground mining operations for approximately 10 years LOM. Coal will be produced primarily for export markets, with some product also available for the local market (e.g. Eskom). The proposed project would create job opportunities to approximately 117 people.

All mineral processing will take place at the Delta Processing Plant near Ermelo, Mpumalanga and as such the Leiden Coal Mine will require limited infrastructure. Infrastructure that is required, and that has been applied for includes haul roads, dewatering pipelines, pollution control dams, a pit dewatering dam, diesel storage and a temporary general waste storage facility. A detailed project description is provided in Section 4 of this report.

1.3 PROJECT LOCATION

The site for the proposed Leiden Coal Mine is located approximately 58km southeast of the town Ermelo and approximately 61km northwest of Piet Retief in the Mpumalanga Province of South Africa. Leiden is located 18km south southeast of the small settlement Sheepmoor. The proposed Leiden coal mine is located on the Remaining Extent of the Farm Leiden 340 IT. The proposed site covers an area of approximately 1 291 hectares and falls within the jurisdiction of the Mkhondo Local Municipality in the Gert Sibande District Municipality. The locality of the application area is presented in Figure 1 below.

Mashala does not currently own any surface rights at Leiden. As such a formal agreement with the surface rights owners will be required. A list of farm portions and registered owners is provided below.

Table 1: List of land parcels and surface rights holders

Farm Name	Farm Portion	Registered Owner
Leiden 340 IT	RE	Le Roux van Niekerk

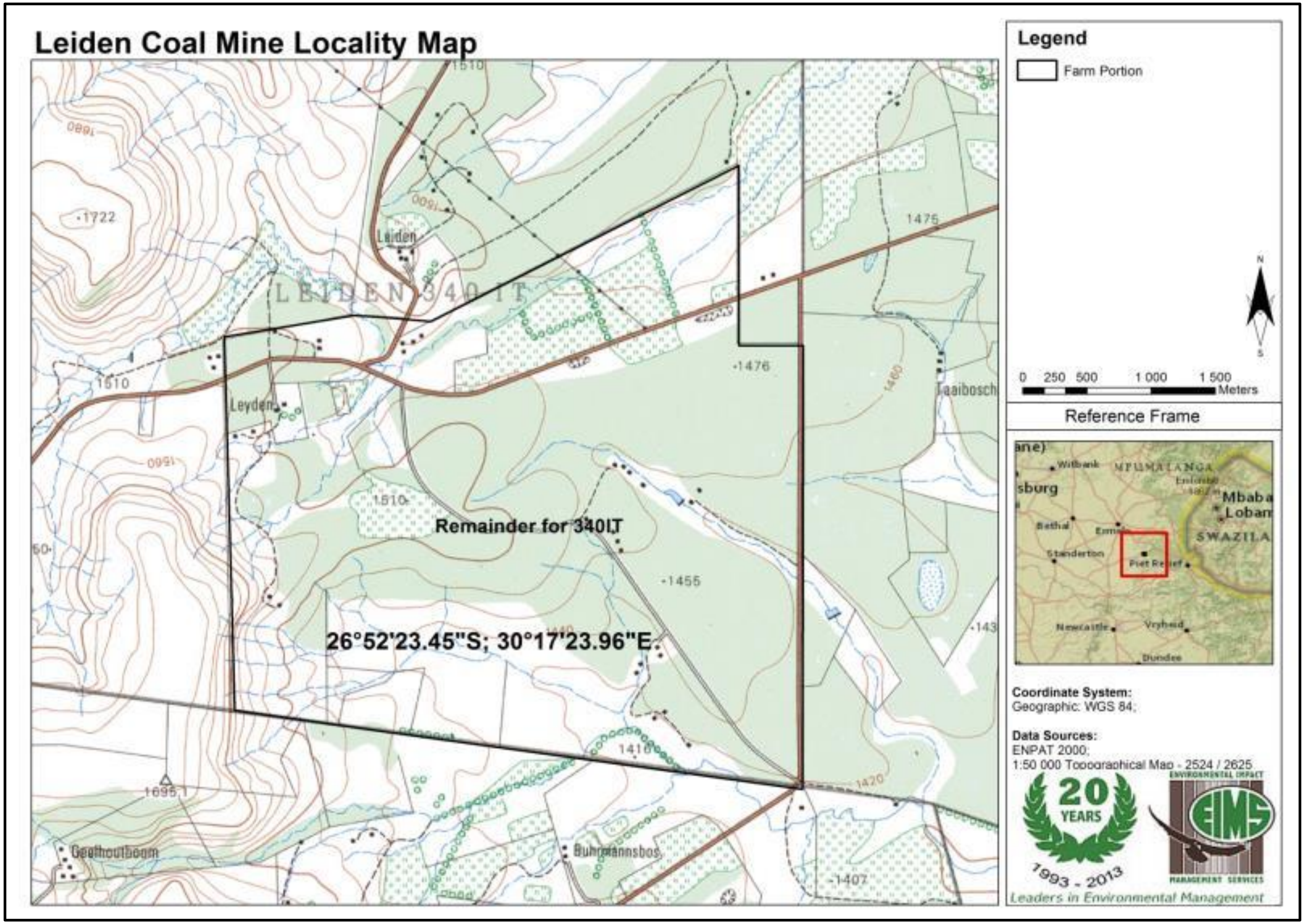


Figure 1: Locality Map

1.4 CONTACT DETAILS OF THE APPLICANT

The applicant is Mashala Resources (Pty) Ltd. The relevant contact person for the project is Yolandie Du Randt and her details are provided below:

Table 2: Applicant contact details

ITEM	COMPANY CONTACT DETAILS
Applicant	Mashala Resources (Pty) Ltd
Name	Yolandie Du Randt
Tel no	011 881 1420
Fax no:	086 206 4487
E-mail address	Yolandie@conticoal.com
Postal address	P.O. Box 787646 Sandton City 2146

1.5 PROJECT MOTIVATION

The proposed Leiden Coal Mine will have favourable economic impacts on both the local and regional economies. Expenditure on the construction and operation of the mine will lead to positive economic impacts as they would constitute an injection of capital into the local and regional economy resulting in increased commercial activity. Coal will be produced primarily for export markets, with some product also available for the local market (e.g. Eskom). The production and sale of coal will ensure a constant inflow of foreign capital into South Africa and into the project region as well as providing further low quality coal to Eskom for use in coal fired power stations thereby ensuring future energy demand within the country.

The proposed Leiden Coal Mine will provide employment opportunities for a workforce from the surrounding area which houses many historically disadvantaged South Africans that require employment. It is the intention of the mine to give priority to the local community when recruiting people for the jobs associated with the mine activities. 102 employees will be employed on the mine when it is fully operational. Note that not all mining operations will be contracted out. The personnel on the mine will however have the necessary skills to conduct the mining operations. Since the Leiden Mine is not in existence, all required infrastructure would need to be constructed. Thus the construction work necessary to bring the mine into operation. Various employment opportunities will therefore arise through the construction of the mine. Although the proposed project will only create a small addition to the existing employment opportunities in the area, the project will ensure the following:

- A mining operation with a sustainable life of mine of approximately 10 years;
- Provision of sustainable employment (retention);
- On-going economic input into the area;
- Provision of a regional socio-economic benefit;
- Economic injection into the region in terms of small business enterprises (e.g. community services);
- On-going supply of export and local coal; and
- Supply of coal to ESKOM when needed.

Mashala will adopt a systematic, fully integrated process of workforce planning as outlined in the Social and Labour Plan (SLP), that involves proactively planning ahead to avoid skills surpluses or shortages. This integrated process is designed to ensure that the right people are in the right roles to meet the current and future organisational requirements. This includes identifying the skills required and the mechanisms by which those skills will be acquired. Such human resource planning mechanisms will continue to be utilised during the life of the operation.

A preferential procurement policy will be developed during the 2014 period that will clearly state the Mine's commitment to BEE. In terms of the Mining Charter, the policy will specifically focus on procurement from HDSA vendors and to promote new opportunities for meaningful participation by Historically Disadvantaged South African (HDSA) companies in Leiden Coal Mine's procurement spend. The company is committed to ensure that all employees in need of basic numeracy and literacy training have access to accredited ABET facilities. The policy will specifically focus on procurement from HDSA vendors and to promote new opportunities for meaningful participation by HDSA companies in Leiden Coal Mine's procurement spend.

The policy will make provision for the following methodology:

1. New suppliers will be required to disclose information regarding their ownership/control and internal BEE programmes;
2. Leiden Coal Mine will put measures into place to monitor and verify the status quo of various suppliers and to ensure that such information is reliable;
3. Preference will be given to products supplied and services rendered by HDSA suppliers;

4. The Mine will encourage suppliers to form partnerships or joint ventures with HDSA supplier companies where there is no HDSA mine tendering to supply the required goods or services; and
5. Tender requirements will be comprehensively communicated to HDSA companies.

The proposed Leiden Coal Mine will fully subscribe to the principles of the Mining Charter, and strive to achieve more than the minimum requirements. The Applicant believes that Employment Equity is an integral part of building an effective and representative workforce and to ensuring equality for all employees. The Mine will therefore develop an Employment Equity Policy to ensure that HDSA employees, especially women, are developed and targets are met. Particular effort will be directed at identifying HDSA's with talent, and providing accelerated training and development initiatives to assist their progression. These vacancies require skills to conduct the intended mining operations. 117 employees will be employed on the mine when it is fully operational.

1.6 THE ENVIRONMENTAL ASSESSMENT TEAM

Mashala has appointed EIMS to act as the independent Environmental Assessment Practitioner (EAP) for the proposed Leiden project. EIMS consists of a team of specialists from a broad range of fields. Details of the environmental specialist team are provided below.

1.6.1 ENVIRONMENTAL IMPACT MANAGEMENT SERVICES (PTY) LTD

Environmental Impact Management Services (Pty) Ltd (EIMS) was founded in 1993 and has steadily grown to be a significant player in the environmental management consulting industry in South Africa and the rest of Africa. EIMS and its resources have been involved with many significant EIA projects involving the and offers access to a broad body of knowledge and experience with the various Integrated Environmental Management tools (EIA; EMPR; EMP; SEA; EMF; etc.). EIMS is responsible for project management and the compilation of the Environmental Management Programme (EMPR) and EIA/EMP for the Leiden project with the input of the specialists listed below.

1.6.2 SPECIALIST CONSULTANTS

The following table lists the specialists responsible for each component of the scoping report and EIA:

Table 3: List of specialists appointed to the project

Component	Company Responsible
Air Quality	Airshed Planning Professionals
Blasting and Vibration	Blast Management Consulting

Component	Company Responsible
Closure Costing, Rehabilitation and Final Land Use	Reichardt and Reichardt
Economic	Strategy 4 Good
Fauna	David Hoare Consulting
Flora	Spatial Ecologist
Geochemistry	Ferret Mining and Environmental Services
Geohydrology	GCS Water and Environment
Heritage	Professional Grave Solutions
Noise	Enviro-Acoustic Research
Social	Equispectives Research and Consulting Services
Social and Labour Plan	Equispectives Research and Consulting Services
Soils, Land Use and Land Capability	ARC Institute for Soil, Climate and Water
Surface Water	GCS Water and Environment
Traffic	ITS Engineers
Visual	Newtown Landscape Architects
Wetlands and Aquatic Ecology	Wetland Consulting Services

2 LEGAL FRAMEWORK

The proposed Leiden Coal Mine requires authorisation in terms of the following interlinked pieces of legislation:

- The Mineral and Petroleum Resources Development Act (MPRDA, Act No. 28 of 2002);
- The National Environmental Management Act (NEMA, Act No. 107 of 1998);
- The National Environmental Management Waste Act (NEMWA, Act No, 59 of 2008); and
- The National Water Act (NWA, Act No. 36 of 1998).

These pieces of legislation stipulate the required studies, reports and legal processes to be conducted and the results thereof submitted to the relevant authorities for approval prior to commencement.

2.1 ENVIRONMENTAL AUTHORISATION PROCESS

As a result of the requirements of the legislation listed above, the proposed project is required to undertake three processes in order to apply for environmental authorisation to the relevant authorities.

Two of the processes, namely the MPRDA and NEMA processes have been undertaken in parallel and have culminated in this Draft Integrated Environmental Management Programme. Pending presentation of the results of the EIA and inclusion of comment from I&AP's the report will be finalised and submitted for adjudication by DMR and MDEDET respectively.

The Public Participation Processes required by all three processes is being undertaken simultaneously and will conclude with the review of the Integrated Water Use License Application review by I&AP's, pending the finalisation and submission of this Integrated Environmental Management Programme as stipulated by the Department of Water Affairs (DWA).

2.1.1 MPRDA PROCESS

In support of the new order mining right application submitted by Mashala, the applicant is required as to conduct an EIA /EMP and I&AP consultations to be submitted to the DMR for adjudication. This report has been compiled in accordance with Regulations 50, 51, 52, 53 and 54 of the MPRDA in order to satisfy the criteria for an EMPR. Pending presentation of the results of the study and inclusion of comment from I&AP's the final report will be submitted to the DMR.

2.1.2 NEMA PROCESS

In terms of Chapter 5 of the NEMA, the proposed Leiden Coal Mine is required to conduct the necessary environmental process and submit an application for Scoping and EIA/EMP to

Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) and the National Department of Environmental Affairs (DEA). The activities applied for are listed in Section 4.13. This report has been compiled in accordance with Regulations 31, 32 and 33 of the NEMA in order to satisfy the criteria for an EIA and EMP. Pending presentation of the results of the study and inclusion of comment from I&AP's the final report will be submitted to the MDEDET and the DEA.

2.1.3 NWA PROCESS

Water may not be used without prior authorisation by the DWA. Due to the requirements of the NWA, the applicant is required to compile and submit for adjudication an Integrated Water Use License Application (IWULA) for the following Section 21 water uses:

- Section 21 (a) – Taking water from a water resource;
- Section 21(b) – Storing water;
- Section 21(c) - Impeding or diverting the flow of water in a watercourse;
- Section 21(d) - Engaging in a stream flow reduction activity contemplated in section 36;
- Section 21 (f) – Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- Section 21(g) - Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21 (i) – Altering the beds, banks, course or characteristics of a water course; and
- Section 21(j) - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

The IWULA, under advice from the DWA is to be compiled and submitted once the final Integrated Environmental Management Programme has been completed, reviewed by I&AP's and submitted to the relevant authorities. This process will likely be completed in early 2015.

2.2 REPORT STRUCTURE

This document is compiled as an Integrated Environmental Management Programme Report in order to meet the legislative requirements for EIA's and EMP's as stipulated in the respective regulations of the MPRDA and NEMA. The following reference documents, listed below were consulted to develop the framework and reporting structure of this report. The reference documents include, at a minimum, the following resources:

- MPRDA EMPR Requirements:

- Regulation 50 of GNR 527 of 23 April 2004: Mineral and Petroleum Resources Development Regulations – Contents of Environmental Impact Assessment Report;
- Regulation 51 of GNR 527 of 23 April 2004: Mineral and Petroleum Resources Development Regulations – Environmental Management Programme; and
- The DMR Environmental Impact Assessment and Environmental Management Programme Report Guideline and Template (2012).

- NEMA EIA/EMP Requirements
  - Regulations 31 of GNR 543 of 18 June 2010: Environmental Impact Assessment Regulations – Environmental Impact Assessment Reports; and
  - Regulation 33 of GNR 543 of 18 June 2010: Environmental Impact Assessment Regulations – Content of Draft Environmental Management Programme.

The structure of the report is tailored to meet the requirements of the above mentioned regulations and as such the information presented, and its location in reference to the requirements of the regulations listed above is provided, below in tabular form for ease of reference

Table 4: Report structure

Environmental Regulation	Description	Section in Report
MPRDA Regulation 527 (2004) as amended		
Regulation 50(a):	An assessment of the environment likely to be affected by the proposed mining operation, including cumulative environmental impacts.	7. Assessment and Evaluation of Potential Project Impacts
Regulation 50(b):	An assessment of the environment likely to be affected by the identified alternative land use or developments, including cumulative environmental impacts.	6. Alternative Land Use and Developments
Regulation 50(c):	An assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation, including the cumulative environmental impacts.	7. Assessment and Evaluation of Potential Project Impacts 7.1. The Impact Assessment Methodology
Regulation 50(d):	A comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts.	6. Alternative Land Use and Developments 6.3. Development Alternatives 6.4Comparative Land use Assessment
Regulation 50(e):	Determine the appropriate mitigatory measures for each significant impact of the proposed mining operation.	13. Environmental Management Principles

Environmental Regulation	Description	Section in Report
		21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts 22. Planned Environmental Monitoring
Regulation 50(f):	Details of the engagement process of interested and affected persons followed during the course of the assessment and an indication of how the issues raised by interested and affected persons have been addressed.	9. Stakeholder Engagement 9.6. Issues and Responses
Regulation 50(g):	Identify knowledge gaps and report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information.	10. Adequacy of Predictive Methods, Underlying Assumptions and Uncertainties
Regulation 50(h):	Description of the arrangements for monitoring and management of environmental impacts.	11. Description and Arrangement for Monitoring and Management of Environmental Impacts
Regulation 50(i):	Inclusion of technical and supporting information as appendices, if any.	12. Technical Supporting Information 27. Technical Supporting Information
Regulation 51(a):	A description of the environmental objectives and specific goals for – • Mine closure;	6. Alternative Land Use and Developments 6.4. List of Potential Impacts on

Environmental Regulation	Description	Section in Report
	• The management of identified environmental impacts emanating from the proposed mining operation; • The socio-economic conditions as identified in the social and labour plan; and • Historical and cultural aspects, if applicable.	Socio-Economic Conditions of Third Party Land Use Activities 6.4.5. Potential Impact on Cultural Aspects and Heritage Features 21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts 25. Rehabilitation Aims and Objectives
Regulation 51(b)(i):	An outline of the implementation programme which must include a description of the appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspects for each phase of the mining operation.	21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts
Regulation 51(b)(ii):	An outline of the implementation programme which must include action plans to achieve the objectives and specific goals contemplated in paragraph (a) which must include a time schedule of actions to be undertaken to implement mitigatory measures for the prevention, management and remediation of each environmental impact, socio-economic condition and historical and cultural aspects for each phase of the mining operation.	21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts
Regulation 51(b)(iii):	An outline of the implementation programme which must include procedures for	20. Procedure for Environmental Emergencies and Remediation

Environmental Regulation	Description	Section in Report
	environmental related emergencies and remediation.	
Regulation 51(b)(iv):	An outline of the implementation programme which must include planned monitoring and environmental management programme performance assessment.	22. Planned Environmental Monitoring 23. The EMPR Performance Assessment
Regulation 51(b)(v):	Financial provision in relation to the execution of the environmental management programme which must include – • The determination of the quantum of the financial provision contemplated in regulation 54; and • Details of the method providing for financial provision contemplated in regulation 53.	26. Financial Provision 26.1. Annual Forecasted Financial Provision 26.2. Confirmation of Amount to be Provided 26.3. Method of Providing Financial Provision 28. Capacity to Manage and Rehabilitate the Environment
Regulation 51(b)(vi):	An environmental awareness plan contemplated in section 39(3)(c) of the Act	19. Environmental Awareness Plan and Training
Regulation 51(b)(vii):	All supporting information and specialist reports that must be attached as appendices to the environmental management programme.	12. Technical Supporting Information 27. Technical Supporting Information
Regulation 51(b)(viii):	An undertaking by the applicant to comply with the provisions of the Act and regulations thereto.	29. Undertaking Signed by Applicant

Environmental Regulation	Description	Section in Report
NEMA Regulation 543 (2010) as amended		
Regulation 31(2)(a):	Details of – • The EAP who compiled the report; and • The expertise of the EAP to carry out an environmental impact assessment.	1. Introduction 1.6. The Environmental Assessment Team
Regulation 33(2)(b):	A detailed description of the proposed activity.	4. Proposed Mining Operation Description
Regulation 33(2)(c)	A description of the property on which the activity is to be undertaken and the location of the activity on the property.	1. Introduction 1.3. Project Location
Regulation 33(2)(d)	A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic, and cultural aspects of the environment may be affected by the proposed activity.	3. The Baseline Receiving Environment 3.1. Cultural and Heritage Resources 3.2. Social 3.3. Economic 3.4. Geology 3.5. Topography 3.6. Climate 3.7. Soils

Environmental Regulation	Description	Section in Report
		3.8. Land Use 3.9. Land Capability 3.10. Flora 3.11. Fauna 3.12. Surface Water 3.13. Wetlands 3.14. Aquatic Ecology 3.15. Ground Water 3.16. Air Quality 3.17. Visual 3.18. Noise 3.19. Blasting and Vibration 3.20. Traffic
Regulation 33(2)(e)	Details of the public participation process conducted in terms of sub-regulation (1), including – • Steps undertaken in accordance with the plan of study; • A list of persons, organisations and organs of state that were registered as interested and affected parties; • A summary of comments received from, and a summary of issues raised by	9. Stakeholder Engagement 9.1. Legal Compliance 9.2. Public Participation Methodology 9.3. Identification of I&AP's

Environmental Regulation	Description	Section in Report
	registered interested and affected parties, the date of receipt of these comment and the response of the EAP to those comments; and • Copies of any representations and comments received from registered interested and affected parties.	9.4. Notification of I&AP's 9.5. Public Participation Open Days 9.6. Issues and Responses
Regulation 33(2)(f)	A description of the need and desirability of the proposed activity.	1. Introduction 1.5. Project Motivation
Regulation 33(2)(g)	A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives ay have on the environment and the community that may be affected by the activity.	6. Alternative Land Use and Developments 7. Assessment and Evaluation of Potential Project Impacts
Regulation 33(2)(h)	An indication of the methodology used in determining the significance of potential environmental impacts.	7. Assessment and Evaluation of Potential Project Impacts 7.1. The Impact Assessment Methodology
Regulation 33(2)(i)	A description and comparative assessment of all alternatives identified during the environmental impact assessment process.	6. Alternative Land Use and Developments 7. Assessment and Evaluation of Potential Project Impacts
Regulation 33(2)(j)	A summary of the findings and recommendations of any specialist report on a	3. The Baseline Receiving

Environmental Regulation	Description	Section in Report
	specialised process.	Environment
Regulation 33(2)(k)	A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures.	7. Assessment and Evaluation of Potential Project Impacts
Regulation 33(2)(l)	An assessment of each identified potentially significant impact, including – • Cumulative impacts; • The nature of the impact; • The extent and duration of the impact; • The probability of the impact occurring; • The degree to which the impact can be reversed; • The degree to which the impact may cause irreplaceable loss of resources; and • The degree to which the impact can be mitigated.	7. Assessment and Evaluation of Potential Project Impacts Appendix A
Regulation 31(2)(m)	A description of any assumptions, uncertainties and gaps in knowledge.	10. Adequacy of Predictive Methods, Underlying Assumptions and Uncertainties
Regulation 31(2)(n)	A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	30. Environmental Impact Statement and Conclusion
Regulation 31(2)(o)	An environmental impact statement which contains –	6. Alternative Land Use and

Environmental Regulation	Description	Section in Report
	• A summary of the key findings of the environmental impact assessment; and • A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.	Developments 7. Assessment and Evaluation of Potential Project Impacts 30. Environmental Impact Statement and Conclusion
Regulation 31(2)(p)	A draft environmental management programme containing the aspects contemplated in regulation 33.	21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts
Regulation 31(2)(q)	Copies of any specialist reports and reports on specialised processes complying with regulation 32.	12. Technical Supporting Information
Regulation 31(2)(r)	Any specific information that may be required by the competent authority.	
Regulation 31(2)(s)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act.	
Regulation 33(a)	Details of – • The person who prepared the environmental management programme; and • The expertise of that person to prepare an environmental management programme.	1. Introduction 1.6. The Environmental Assessment Team
Regulation 33(b)	Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated	21. Action Plans to Achieve Objectives and Goals and Technical OR Management

Environmental Regulation	Description	Section in Report
	by these regulations, including environmental impacts or objectives in respect of – • Planning and design; • Pre-construction and construction activities; • Operation or undertaking of the activity; • Rehabilitation of the environment; and • Closure, where relevant.	Options for Impacts
Regulation 33(c)	A detailed description of the aspects of the activity that are covered by the draft environmental management programme.	5. Potential Impacts of the Mining Operations 5.1. List of Potential Impacts on Environmental Aspects
Regulation 33(d)	An identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b).	16. Roles and Responsibilities
Regulation 33(e)	Proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon.	17.6. Auditing and Reporting Procedures 21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts 23. The EMPR Performance Assessment
Regulation 33(f)	As far as is reasonably practicable, measures to rehabilitate the environment affected	21. Action Plans to Achieve Objectives and Goals and

Environmental Regulation	Description	Section in Report
	by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures.	Technical OR Management Options for Impacts 25. Rehabilitation Aims and Objectives
Regulation 33(g)	A description of the manner in which it intends to – • Modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; • Remedy the cause of pollution or degradation and migration of pollutants; • Comply with any prescribed environmental management standards or practices; • Comply with any applicable provisions of the Act regarding closure, where applicable; and • Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.	21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts 24. Closure Goals and Objectives 25. Rehabilitation Aims and Objectives 26. Financial Provision
Regulation 33(h)	Time periods within which the measures contemplated in the environmental management programme must be implemented.	21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts
Regulation 33(i)	The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity.	21. Action Plans to Achieve Objectives and Goals and Technical OR Management Options for Impacts
Regulation 33(j)	An environmental awareness plan describing the manner in which –	19. Environmental Awareness

Environmental Regulation	Description	Section in Report
	• The applicant intends to inform his or her employees of any environmental risk which may result from their work; and • Risks must be dealt with in order to avoid pollution or the degradation of the environment.	Plan and Training
Regulation 33(k)	Where appropriate, closure plans, including closure objectives	24. Closure Goals and Objectives

3 THE BASELINE RECEIVING ENVIRONMENT

The description of the baseline receiving environment (on site and surrounding) was obtained from the studies undertaken by the specialist team and in conjunction with EIMS. All specialist studies undertaken for the proposed Leiden Coal Mine are included as supporting technical appendices to this report. A list of these reports and corresponding appendices are included in Section 12.

3.1 CULTURAL AND HERITAGE RESOURCES

Professional Grave Solutions (PGS), Heritage and Grave Relocation Consultants was appointed by EIMS to undertake the archaeological and palaeontological specialist study for the Leiden project. The following sections provide a summary of the cultural heritage environment that may be affected by the proposed Leiden project. Information has been sourced from the Heritage EIA report. For further information, please refer to the full Heritage Impact Report (HIA) which is included in Appendix C.

3.1.1 INTRODUCTION

Mining activities have the potential to destroy, damage, or disturb cultural and heritage resources. These resources include graves, cemeteries, palaeolithic features and structures that are more than 60 years old. It is of great importance to identify these features prior to the mining activities to ensure that they are correctly protected thereby attempting to prevent disturbance or damage to the features.

3.1.2 DATA COLLECTION

A desktop palaeontology study was completed to identify the potential fossiliferous rock units such as groups and formations represented within the study area. These units were determined from geological maps. Literature was utilized from previous paleontological impact studies completed in the same region to support the desktop study.

PGS completed a scoping level assessment of the archaeological and historical background for the Project application area in October 2013. Once the final development area was established by EIMS and the client in cognizance of the findings of the various specialist scoping studies, including the Heritage Scoping Assessment undertaken by PGS Heritage, an HIA was undertaken.

The HIA comprised a collation and application of the scoping phase information and a physical survey undertaken on the 17th of July 2014 by a heritage specialist and fieldwork assistant. The heritage survey focussed on the identified surface layout area. Both members of the fieldwork team were equipped with a hand-held GPS, and an overlay was created of their recorded track logs and the development layout plan.

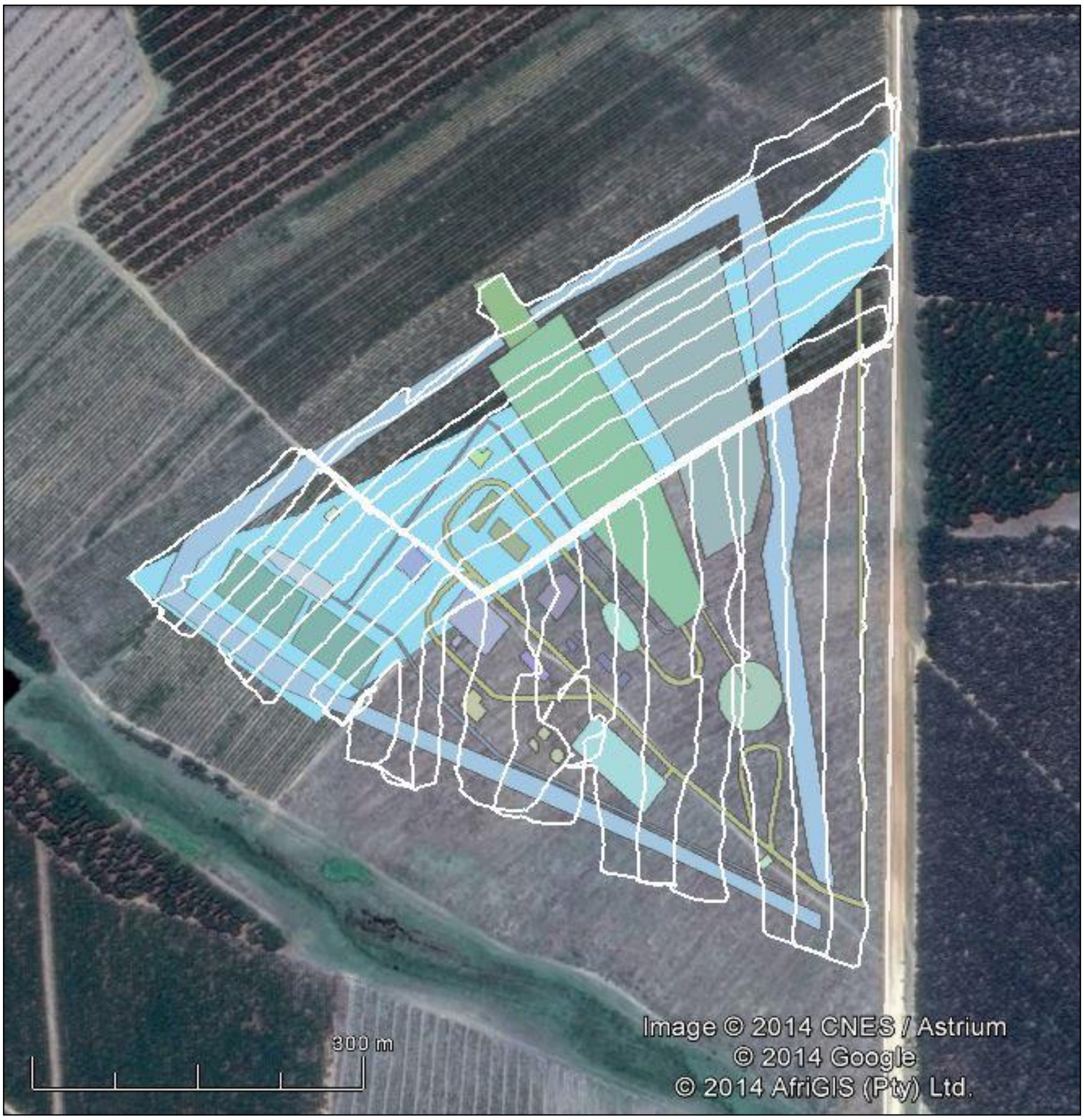


Figure 2: The track logs recorded for during the fieldwork

3.1.3 RESULTS

3.1.3.1 Palaeontology

The project application area is almost entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation. This formation forms part of the Ecca Group, which lies in the Karoo Supergroup. A small section along the western edge of the study area is underlain by Jurassic aged Dolerite. Due to the igneous nature of the rock, dolerite will contain no fossils; however the Vryheid Formation is well known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. According to Bamford (2011), little data has been published on these potentially fossiliferous deposits.

The potential to find well preserved plant fossil material can differ from place to place. These are however more likely to be found around the coal bearing strata than elsewhere. When they do occur fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites. In the interests of heritage and science, however, such sites should be well recorded, sampled and the fossils kept in a suitable institution. With regards to animal fossils, the late Carboniferous to early Jurassic Karoo Supergroup sediments of South Africa are almost entirely lacking in complete fossils. Trace fossils (ichnofossils) are however abundant in the area surrounding the site.

3.1.3.2 Heritage Sites

During the fieldwork it was found that large sections of the development area had been disturbed by the establishment of plantations. Despite an intensive walkthrough of the development area, no heritage sites were identified.

At the time of the fieldwork the brother of the landowner, Mr. Ettienne van Niekerk, was met. Mr. Van Niekerk had grown up on the property and still farms the land. He was asked if he knew of any graves or cemeteries within the development area and he indicated that he did not (Van Niekerk, pers. comm.).

During the Heritage Scoping Study undertaken of the entire property known as the Remainder of the farm Leiden 340 IT, a total of nine heritage sites were identified. These nine sites comprise six cemeteries, one historic farmstead, one historic farm worker dwelling and one historic rock engraving. None of these sites are in any way close to the present study area, with the site that is closest to the development area situated roughly 1.3km away. As a result, no impacts from the proposed mining development are expected on these identified heritage sites. The desktop study undertaken yielded the presence of a number of homesteads within the study area. Although none of these were identified during the site visit, the possibility remains that they have not been destroyed by previous activities occurring on the site. For full detail of these heritage sites please refer to the HIA in Appendix C.

3.1.3.2.1 Historical Sites and Structures

The second edition of the 2630CD topographical sheet that was compiled in 1985 and printed in 1990 depicts a black homestead in close proximity to the south-western corner of the proposed development area. As this homestead is not depicted on the first edition of the same topographical sheet that was surveyed and printed in 1971, the suggestion is that the homestead was established between 1971 and 1985.

Past experience has shown that in some cases stillborn babies were buried in close proximity to such black homesteads and especially along the sides of the parents' dwelling. This seems to be especially true for older sites, but sites occupied during the 1970s and the 1980s are also associated with this cultural aspect. As this site was abandoned some time ago, no direct information with regards to the presence (or not) of stillborn graves are currently available.

Based on information that is presently available, the homestead is located roughly 20m outside of the development footprint. However, due to potential slight inaccuracies on the original map as well as the calculations and overlays undertaken for the present study, it is always possible that the homestead is located within the study area. Although no evidence for the homestead remains were found during the archaeological walkthrough, the fact that large sections of the site had been disturbed by forestry activities would make any identification of the tangible remains of such a homestead very difficult.

The estimated position of the homestead is presently located in an area which had been utilised for forestry. As a result it is highly likely for the homestead to have been destroyed as part of these activities.

Figure 3: The approximate position of the Black Homestead in relation to the footprint area of Alternative 3

3.1.3.3 Site Sensitivities and Constraints

A paleontological desktop study revealed that the study area is entirely underlain by sedimentary rocks of the Permian aged Vryheid Formation, Ecca Group, Karoo Supergroup, with only a small section along the western edge of the study area underlain by Jurassic aged Dolerite. The Vryheid Formation is known for containing an abundant assemblage of plant fossils and the mining of coal is by definition the mining of fossil plant material which is considered a site sensitivity.

The heritage feature on site identified as sensitive is the black homestead which in the past has shown that in some cases stillborn babies are buried in close proximity to such black homesteads and aspecially along the sides of the parents' dwelling.

From the site sensitivities highlighted above it is evident that the following site constraints can be identified for the present development area:

The entire development area can be classified as of Moderate Palaeontological Sensitivity. There is also a slight possibility for stillborn babies to be located in close proximity to the south-western corner of the development area.

3.1.4 CONCLUSION

Due to the fact that the underlying Vryheid Formation sediments and coal beds will only be exposed during the mining operations and associated infrastructure development, it is unlikely that any fossils will be observed before the mining takes place. Dolerite will not contain any fossils because of its igneous nature.

No heritage sites within or in near proximity of the development footprint, other than the remote potential presence of stillborn babies, were identified during the HIA.

3.2 SOCIAL

Equispectives Research and Consulting Services was appointed by EIMS to undertake the social specialist study for the Leiden project. The following sections provide a summary of the social environment that may be affected by the proposed Leiden project. Information has been sourced from the Social EIA Report. For further information, please refer to the full Social Impact Assessment Report (SIA) which is included in Appendix D.

3.2.1 INTRODUCTION

The current social environment for the project area is indicative of a poorer landscape than that of surrounding suburbs in Mpumalanga. As a result it is important to understand the impact that the mining operations will have on the social environment. This socially sensitive area will benefit from an increase in jobs to the area which will in turn increase financial stability among the local people for the life of mine. Expected changes are likely to be seen in the communities as a result of the short term nature of the operations. The mining operations will however be limited in duration (LOM is approximately 10 years) and as a result when operations cease job losses are likely to be seen.

3.2.2 DATA COLLECTION

The information used in this study was based on a literature review, data from Statistics South Africa, the professional judgement of the specialist, public participation documents produced during the EIA process, and focus group, individual, and community meeting with affected parties.

3.2.3 RESULTS

3.2.3.1 Description of the Area

3.2.3.1.1 Mpumalanga Province

The proposed mine is located in the Mpumalanga Province which is located in the north eastern part of South Africa and covers an area of approximately 82 333 km^2 (www.mputopbusiness.co.za). Mpumalanga is South Africa’s major forestry production area and is also the world’s largest producer of electrolytic manganese metal. Mpumalanga currently produces 83% of South Africa's coal. Electricity generation and the synthetic fuel industry account for 90% of South Africa's coal consumption.

3.2.3.1.2 Gert Sibande District Municipality

Spatially the GSDM is the largest district in the Mpumalanga Province, with the smallest population size. More than half of the population stay in urban areas. The settlements are mainly rural in nature with some towns. According to national census data, the poverty rate in the district has declined since 2001 but remains higher than the provincial average. Even though the poverty rate is declining, the actual number of people in poverty is increasing (GSDM IDP 2013/14). The GSDM is said to be dealing with problems in terms of providing basic needs to its community.

3.2.3.1.3 Mkhondo Local Municipality

The project application area is located in in Ward 2 of the Mkhondo Local Municipality in this province, which is located in the GSDM. It must also be noted that the site is relatively close to the borders with the Msukaligwa Local Municipality and the Pixley ka Seme Local Municipality. The main economic activities identified in the MLM are forestry and agriculture. Forestry is the dominant landuse in the municipal area with Mondi, Sappi, TWK and SAFCOL the major players in the forestry industry. The rest of the land within the municipality consists of unimproved grassland used for stock grazing with the cultivation of commercial crops being scattered in small areas across the municipality. Mining does occur in the MLM but the main concentration of mining is situated in the west of the municipality. Tourism is dominated by guesthouse facilities around the town of Piet Retief, while conservancies and private reserve developments are increasing in the Ngwempisi and Assegai River valley and catchments. Figure 4 shows the location of the proposed Leiden Coal Mine in relation to the municipalities described above.

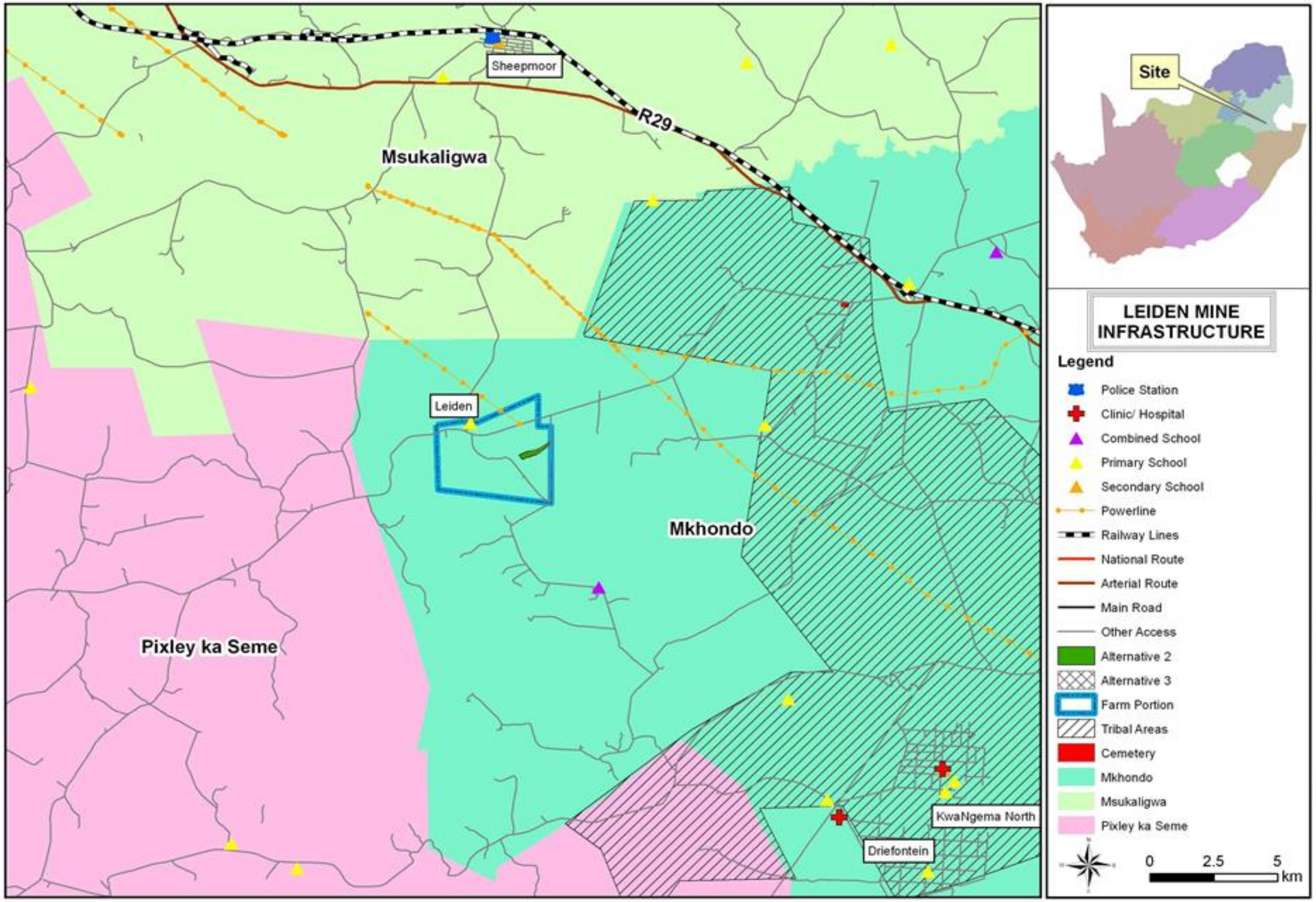


Figure 4: Location of proposed Leiden Colliery in relation to the surrounding municipalities

3.2.3.2 Description of the Population

3.2.3.2.1 Population Composition

Considering the project application area, the majority of the population belongs to the Black population group, but the proportions differ. Ward 2 has the highest proportion of people belonging to the Black population group.

3.2.3.2.2 Age

The age distribution of the study areas under investigation shows that about two fifths of the population of Ward 2 are children aged 14 years or younger. This is higher than on local or district level and places greater pressure on the working age population.

3.2.3.2.3 Gender

The gender distribution for the study areas shows a bias towards females, especially on local and ward level. This can be indicative of males migrating to other areas in search of employment, leaving females behind to look after the children and the aged.

3.2.3.2.4 Language

The dominant home language in Mpumalanga is SiSwati, followed by IsiZulu, Xitsonga, IsiNdebele, and Sepedi. In the MLM almost 90% of the population have IsiZulu as home language, with an even higher proportion in Ward 2. As home language gives an indication of culture, it suggests that the MLM is culturally less heterogeneous than the district or provincial levels.

3.2.3.2.5 Education

The MLM has lower education levels than on district or provincial level, but not as low as on a ward level where a quarter of the population aged 20 years or older have received no schooling.

3.2.3.2.6 Employment

The area around the proposed development is rural in nature with high levels of poverty and unemployment. Ward 2 has the lowest proportion of people of economically active age (aged between 15 years and 65 years) that are employed. The proportion on ward level is almost half of the proportion on district level. This suggests that there are very few employment opportunities in the area. The majority of the employed people in the areas under investigation work in the formal sector. Ward 2 has the highest proportion of people working in the informal sector.

3.2.3.2.7 Household Income

The MLM has a lower average annual household income than on a district or provincial level with more than 80% of the households having a household income of less than R38 201 per year. On a ward level this figure is more than 90%, suggesting that this is a very poor area.

3.2.3.2.8 Housing

In the MLM more than a third of the households live in formal residential areas, and another third live on land that is classified as farms. The MLM has the largest proportion of households living on land classified as farms on all levels. In Ward 2 just over three quarters of households live in traditional residential areas and a fifth live on farms. Most of the dwellings in the area are houses or brick/concrete block structures that are on a separate yard, stand or farm. A large proportion of households in Ward 2 are made of traditional materials. The MLM has the smallest proportion of households that own and have fully paid off the residences, but the largest proportion of households that occupy their dwellings rent-free. In Ward 2 almost two-thirds of households own and have paid their residences off fully. Household sizes on a ward level tend to be much bigger than on local, district or provincial level, with just more than 40% of households consisting of more than four people, compared to just over 30% on local level and less on district and provincial level.

3.2.3.2.9 Access to services

On a ward level, just over half of the households get their water from a local or a regional water scheme while about a fifth gets their water from boreholes. Ward 2 has the highest proportion of households on all levels that get water from a borehole and the lowest proportion of households that get their water from a regional or local water scheme. Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble *et al.* (2006). On a ward level very few households have access to piped water inside the dwelling, but almost half have access to piped water inside the yard while about a third does not have access to piped water at all. Compared to local, district and provincial level, the proportion of people with piped water inside their dwellings are extremely low and the proportion of people with no access to piped water quite high.

In Ward 2 just over 10% of households do not have access to any sanitation services, while three quarters have access to pit toilets without ventilation. Access to clean water and sanitation were some of the major issues raised during IDP/budget consultations (GSDM IDP 2013/14).

Electricity is seen as the preferred source for lighting (Noble *et al*., 2006) and the lack thereof should thus be considered a deprivation. Even though electricity as an energy source may be available, the choice of energy for cooking may be dependent on other factors such as cost. Ward 2 has a higher incidence of households that use electricity as an energy source for lighting than the MLM with more than three quarters of the households in the ward having access to electricity. Candles are the source of lighting that is used second most.

A relatively large proportion of households on both the local as well as ward levels has indicated that they have no rubbish disposal. More than 80% of households on a ward level have indicated that they have their own refuse dumps. Households with their own refuse dumps rely mostly on backyard dumping, burial and burning. These practices adversely impact on human health and the environment.

3.2.3.3 Social Infrastructure

There are several primary schools in the MLM that are widely distributed through the area and generally also cover rural areas (MLM IDP 2012/13). There are 15 secondary schools in the area that are scattered across the wards, but the need for more arises as the population grows. Mondi has a Science and Career Guidance centre that assists in career guidance and youth development for the people of Mkhondo.

There is one hospital in the municipal area that is located in Piet Retief as well as ten other health facilities (mainly clinics). Three of these facilities are located in Piet Retief. In addition there are two alcohol and drug rehabilitation centres, two old age homes, two centres for people with disabilities and two orphanages in the area. There are also four police stations and three post offices in the MLM. There is a need for more health care facilities, especially in rural areas to create easier access to basic health and family planning services.

3.2.3.4 Site Sensitivities and Constraints

From a social perspective areas close to current residences of farmers and farm workers are regarded as having a high sensitivity rating as these people may have to be relocated, and if they are not relocated mining activities have the potential to disrupt their daily lives in terms of environmental nuisances such as vibrations, dust, noise, traffic as well as their sense of place. It must be noted that the farm workers live in traditional dwellings made from clay, which are more susceptible to damage from blasting than brick structures. The area of least concern is where previous mining activities have been indicated as this area has already been disturbed. The areas in between are of low sensitivity as the impact on people will not be that high, but cattle grazing or forestry areas may be impacted on. Therefore the location of the proposed development footprint is considered to have low sensitivity and few constraints.

3.2.4 CONCLUSION

Generally the communities in the area surrounding Leiden 340 IT are poorer than other communities situated in the Mpumalanga Province. This may be attributed to the lower levels of employment and poor infrastructure. Although the area is dominated by agriculture and forestry, jobs are selectively available seasonally for unskilled labourers. The prominent language of the area is SiSwati, which is widely spoken throughout the community. Other dominant languages are IsiZulu, Xitsonga, IsiNdebele, and Sepedi. Education in the area is poor as a result of the lack of schools available.

3.3 ECONOMIC

Strategy4Good was appointed by EIMS to undertake the economic specialist study for the Leiden project. The following sections provide a summary of the economic environment that may be affected by the proposed Leiden project. Information has been sourced from the Economic EIA Report. For further information, please refer to the full Economic Impact Assessment which is included in Appendix E.

3.3.1 INTRODUCTION

The study of economic development, which is generally broad in its scope, refers to the standard of living of citizens; most often measured by GDP per capita, literacy rate, and life expectancy. Economic development incorporates many elements of pure macro-economics, such as price stability, high employment, and sustainable growth. However, this is underpinned by the study of infrastructure and social development programs, such as education, housing, and road networks. The generic aspects that require assessment in the economic impact assessment are outlined below Figure 5.

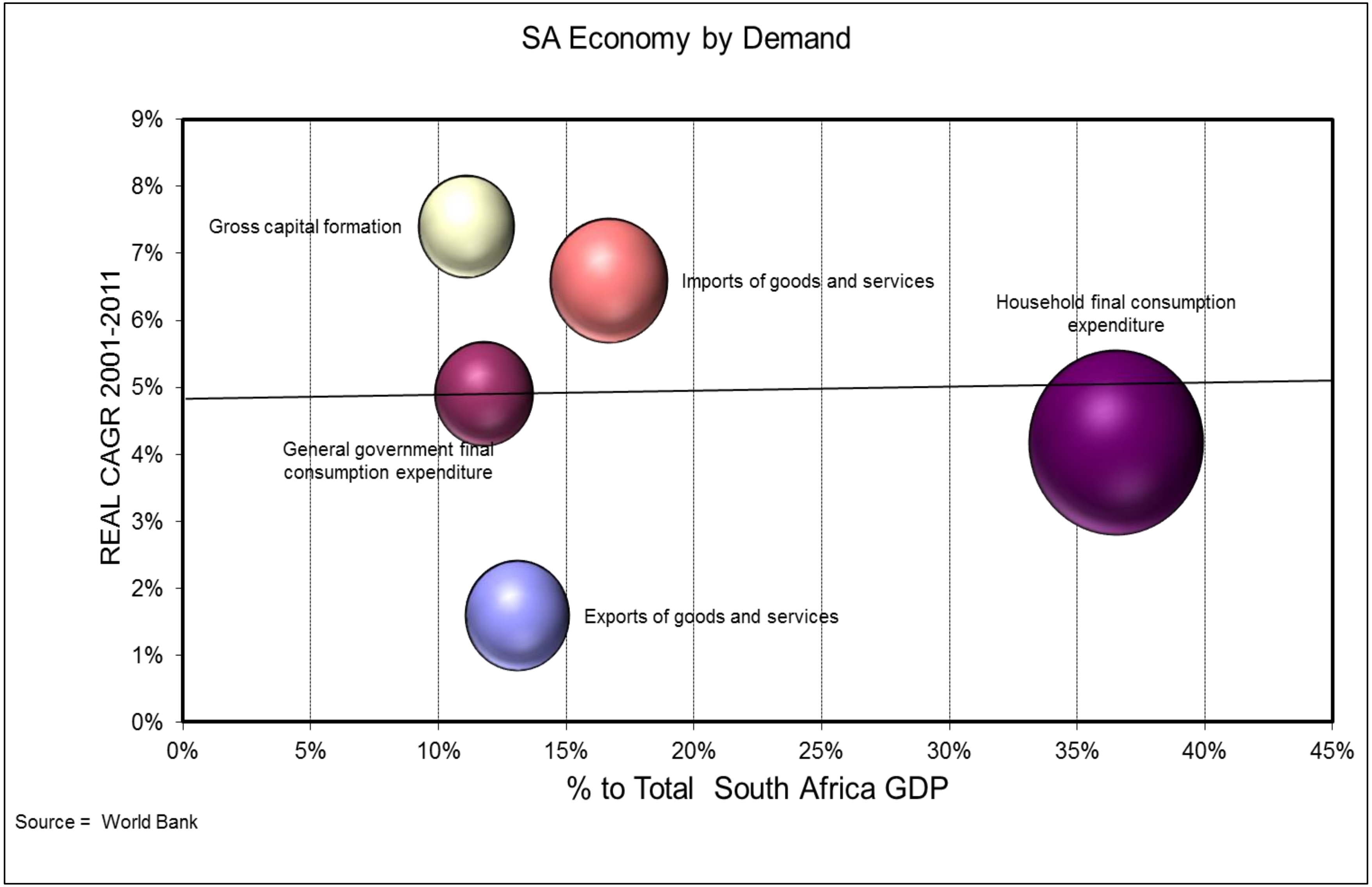


Figure 5: Bubble sizes = GDP by demand factor

Mine operations have the potential to positively or negatively influence/affect the economic environment of the area. Mines contribute directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, mines indirectly contribute to economic growth in the local and regional economies because the increase in the number of income earning people has a multiplying effect on the trade of other goods and services in other sectors. However, the introduction of a mine into an area can have undesirable implications in the surrounding environment. This is because changes occur not only to the pre-existing land uses but also to the existing associated social structures and general way of life. The closure phase of the mine can have highly negative impacts because the surrounding environment loses the economic support that it receives during the operation of the mine. To ensure the economic safety of the communities which are affected by the mining operations, mitigation measures post closure of the mine will need to consider the economic environment of the communities and address these impacts effectively.

3.3.2 DATA COLLECTION

This study is mainly based on secondary economic data. The macro-economic data for this analysis was supplied by Quantec, a reliable regional economic data provider in South Africa.

3.3.3 RESULTS

3.3.3.1 Baseline Economic Environment

The national GDP growth rate is the key indicator of economic trends and business confidence in an economy; and this translates to willingness or unwillingness to invest, which is one of the spurs for any economic growth.

The Quantec data for industry sector GDP's as a percentage of the total South African GDP, measured over the period 2006 to 2011, indicates that the mining and construction industries had relatively good growth rates (in real terms) and the manufacturing industry suffered as a result of weak consumer demand. The largest industry sectors in the economy today are the finance and service industries; which follows trends worldwide where the tertiary sectors are outgrowing the primary and secondary sectors.

Agriculture, an industry sector that ought to be a high employer in the country, has done relatively poorly in the national economy, and its relevance in terms of alternative land-use to mining needs to be noted. The hypothesis can be made that mining development would look more attractive than agricultural development purely based on national industry sector performance. This hypothesis would need to be tested on a micro-level in the Impact Assessment Report.

Figure 6 below provides a comparison of the provincial and national industry sector growth rates, as well as the relative sizes of the industry sectors compared to South Africa as a whole. It is clear that the mining industry sector contributes three (3) times as much to the provincial economy as compared to this industry sector's contribution nationally. Therefore, mining is a very large part of the Mpumalanga's economy and there are locational advantages to development in this sector in the Mpumalanga Province. In addition to this, the mining sector grew more strongly in Mpumalanga than nationally (2001-2011).

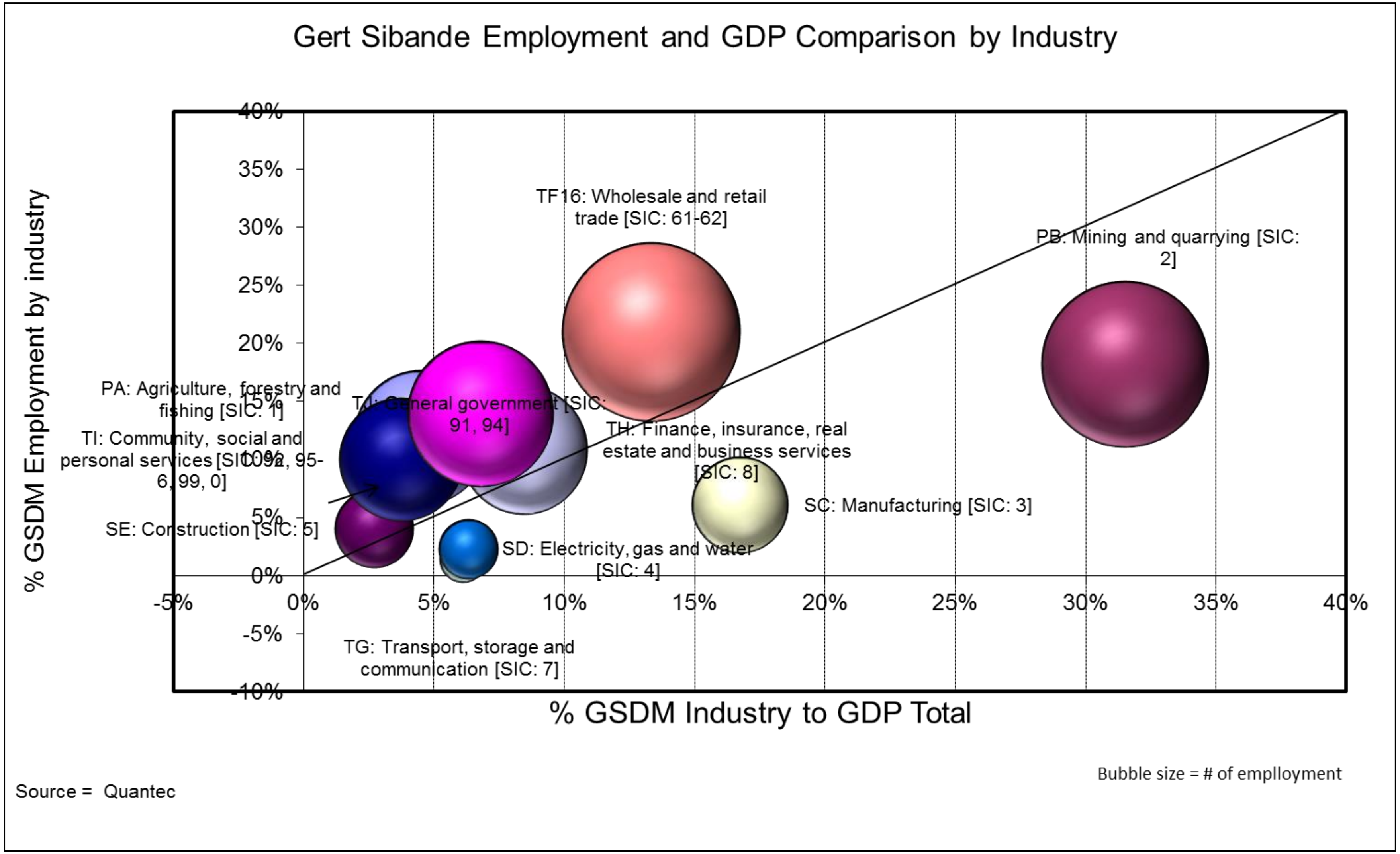


Figure 6: GSDM GDP and Employment Comparison

The mining industry sector is also the mainstay of the GSDM and MLM economies. GSDM has a strong energy nexus, with coal miners, ESKOM, and Sasol very prominent players in the district economy. The GSDM and MLM economies have both grown better than the national economy in the last five years and this is likely due to the strong demand and development in the energy sector.

3.3.3.2 Employment and Under-Employment

The number of people formally employed in the MLM dropped by almost 50% from 2001 to 2011, which is probably the result of the downscaling of forestry operations. Timber and forestry remain under serious threat due to the increasing use of technology and a lower demand for paper in the economy. It also highlights the devastation caused by business discontinuity, of which mine closure in itself is a good example, and this aspect would require in-depth thought during mine development.

It is noteworthy that only 2 out of 10 working age people in the MLM have a formal job. This factor is a major driver in the emigration of people from this municipality. The national average for formal employment is approximately 3 out of 10 people, which is only slightly better than the MLM employment level.

Looking at the GDP versus Employment profile of the MLM below (Figure 7), one finds that 50% of formal employment is in the primary sector, namely mining and agriculture. This in itself poses a potential dilemma for alternative land-use as both these industries are heavily reliant on land and water resources for its well-being. Thus at any given time, these two industries are likely to compete for land-use and this will have a major impact on employment and livelihoods.

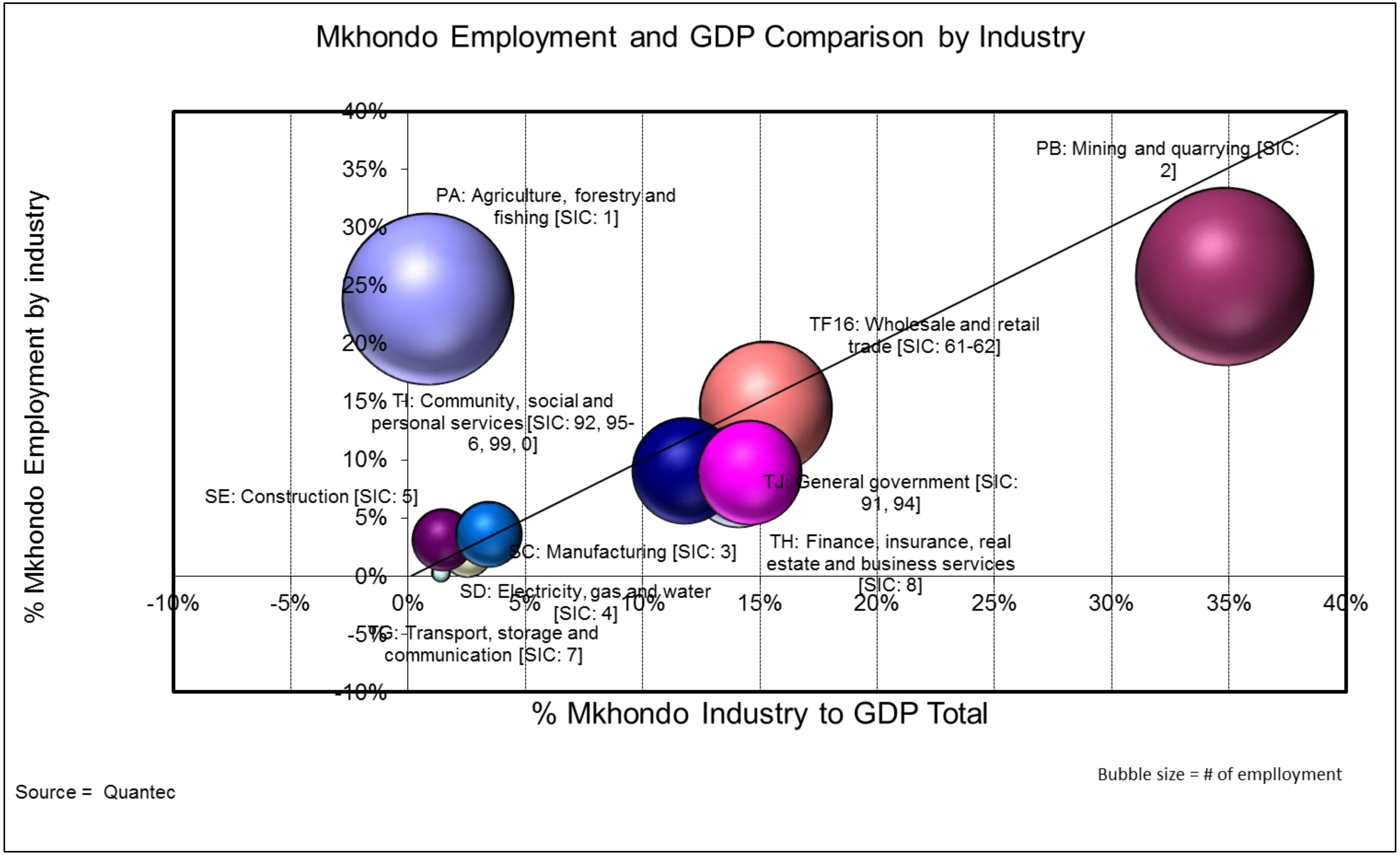


Figure 7: Mkhondo Employment

3.3.3.3 Economic Contribution of the Proposed Mine

The coal resources over the period of the LoM are estimated at 18 363 715 tonnes (measured, indicated, and inferred). It is estimated that a total of 2 199 404 tonnes of coal will be sold over the LoM; of which approximately 65% will be exported and 35% will be sold locally to Eskom. The total revenue is estimated at R1.3 billion over the life of mine.

One hundred and seventeen (117) jobs are expected to be created by the implementation and production of the Leiden Coal Mine. Although the mining activities offer a period of increased job availability, this is short term as a mine is by definition not a sustainable enterprise. The Leiden Coal Mine will only be operational for 10 years. However, it is likely that several positive economic impacts will remain after closure of the mine.

3.3.3.4 GSDM Economic Development Plan

It will be vital for the proposed Mine to align with the GSDM Economic Development Plan. The GSDM, in its 2012/13 IDP, recognises the key problem of unemployment in the district's economy and has proposed the following initiatives to increase economic growth and improve employment:

- Sustainable Integrated Agricultural Development Programme for GSDM Land Reform Projects
- Establishment of the GSDM Development Agency;
- Potential Economic Development Corridors;
- Heyshope Dam Scoping Study;
- District Industrial Development Strategy (DIDS);
- Mining Beneficiation Master Plan;
- New Regional Information Management and Tourism Exhibition Centre;
- Development of the District Biodiesel Plant;
- SMME/Co-operatives Development and Support;
- Responsible Tourism Development, Promotion and Support;
- Development of a Regional Airport;
- Development and operationalization of a Region Library and Exhibition Centre;
- Promotion of Urban Renewal Programmes within the Municipality;
- Promote the Expansion of the Greening Economy in the District;
- Regional Training (Skills Development); and
- Establishment of a Regional Sports Complex.

For further information regarding each of the above initiates, please refer to the full economic report included in Appendix E of this report.

3.3.4 CONCLUSION

The Mpumalanga economy benefits from the strong demand for energy provided by coal fired power stations. In addition, the major industry sectors in the Mpumalanga economy, mining and manufacturing, are likely to exhibit sustainable economic growth in the future. This emphasises the strong economic need for coal resources for energy production. It is also noted that the MLM is in great need of business investment and job creation due to a reduction in employment levels over the last decade, as a result of the downscaling of forestry operations. Therefore the Leiden Coal Mine fits with the overall provincial economic structure in terms of employment and industry sector growth.

3.4 GEOLOGY

The information presented below was summarised from the heritage specialist study and the geochemistry specialist study. For further information please refer to the full reports for these studies which are located in Appendix C and Appendix F respectively.

3.4.1 INTRODUCTION

The prevailing baseline geology and associated geological features are significant in that they provide an understanding of the following:

- Geological processes responsible for the determination of soil forms and paleontological resources;
- The potential for sterilisation of mineral resources due to infrastructure placement;
- Geochemistry and potential pollution of water resources from mineralised waste and stockpiles; and
- Preferential flow paths of groundwater that influence the dispersion of potential pollution.

3.4.2 DATA COLLECTION

Information regarding the geology of the area and study site was sourced from published literature together with the findings of the baseline palaeontological and geochemical studies undertaken. The geochemistry report also utilised geological data sourced from SA Data ENPMP00 Map Series in Shapefile format from 2000.

3.4.3 RESULTS

All of the known coal deposits in South Africa are hosted in sedimentary rocks of the Karoo Basin, a large retro foreland basin which developed on the Kaapvaal Craton and filled between the Late Carboniferous and Middle Jurassic periods. The Karoo Supergroup is lithostratigraphically subdivided into the Dwyka, Ecca, and Beaufort groups, succeeded by the Molteno, Elliot, Clarens, and Drakensburg formations. The coals range in age from Early Permian (Ecca Group) through to Late Triassic (Molteno Formation) and are predominantly bituminous to anthracite in rank, which is a classification in terms of metamorphism under the influence of temperature and pressure.

Within the Karoo Basin, nineteen (19) coalfields have been defined based on variations in sedimentation, origin, formation, distribution and quality of the coals. These variations are in turn related to specific conditions of deposition and the local tectonic history of each area. The Project area under discussion is located in the Ermelo Coalfield, historically one of the most important coal producing areas of South Africa.

The Karoo Supergroup succession in the Ermelo Coalfield begins with the Dwyka Group diamictites, which occur unconformably above a pre-Karoo basement. These in turn are overlain by the coal bearing Vryheid Formation (Ecca Group), the basal Pietermaritzburg Formation of the Ecca Group not being present. A number of coarsening and fining upward sequences occur in the Vryheid Formation, which has been given various names by early workers. Cairncross (1986) adapted a more straightforward approach to the stratigraphic analysis of the Vryheid Formation strata, subdividing the entire column into only three simple units, which contain five (5) coal seams. These units are from the base up the A - E Seams sequences. The Vryheid Formation in this region hosts the complete sequence of Ermelo Coalfield coal seams. Numerous Jurassic aged dolerite dykes and sills intrude the Vryheid Formation at various stratigraphic levels. These intrusions tend to influence the stratigraphy and coal qualities in places.

The geochemical environment is fundamentally dictated by the mineralogy of the various lithological units. In general, the area has been divided into three lithological units. i.e. dolomite, arenite, and dolerite (see Figure 8 below). Dolomite refers to the chemical sedimentary rocks of the Malmanie Group consisting of calcium-magnesium carbonate rocks, whereas the arenite refers to the siliciclastic coal-bearing rocks of the Ecca Group (and probably the Vryheid Formation). The dolerite is a late-stage igneous rock which has been emplaced into the sedimentary rocks.

Although Leiden is situated within the Ermelo Coalfield, the seams which occur on the property have been logged as the Ulrecht Coalfield seams of Gus and Dundas. The Gus seam lies stratigraphically above the Dundas seam with a parting of approximately 15 m. The Gus seam occurs at a depth of approximately 30 m from surface with an average width of 0.70 m, whilst the Dundas seam occurs at a depth of 45 m from surface with an average width of 1.45 m. Faults and dolerites occur with the project area. Dolerite was intersected in 8 boreholes. The local dip is typically around 2° to 4° within a local synclinal structure with a central axis striking southwest to northeast.

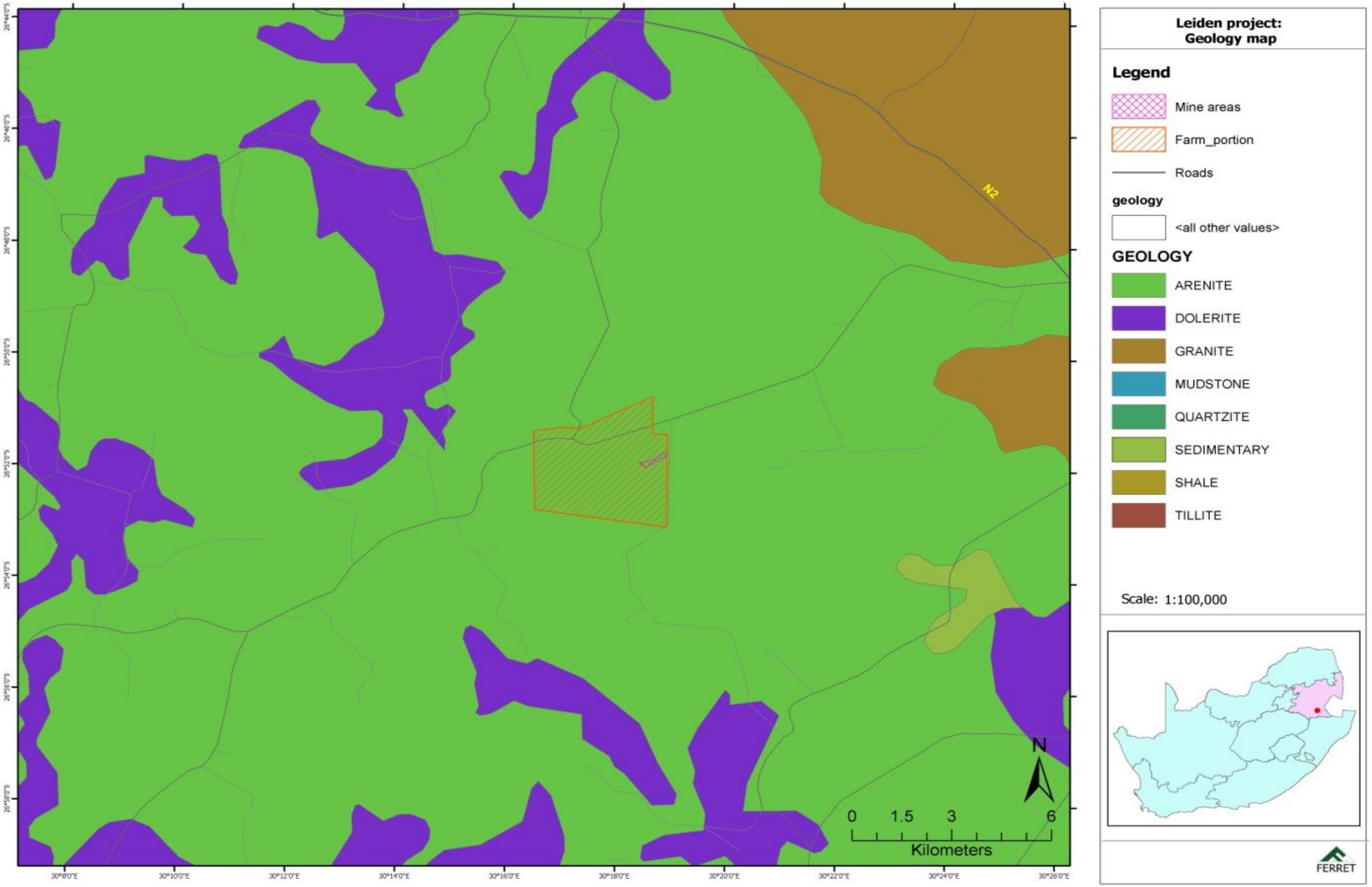


Figure 8: Geology map of the proposed Leiden project area

3.4.4 CONCLUSION

The geochemical environment is fundamentally dictated by the mineralogy of the various lithological units. In general, the area has been divided into three lithological units. i.e. dolomite, arenite, and dolerite. Dolomite refers to the chemical sedimentary rocks of the Malmanie Group consisting of calcium-magnesium carbonate rocks, whereas the arenite refers to the siliciclastic coal-bearing rocks of the Ecca Group (and probably the Vryheid Formation). The dolerite is a late-stage igneous rock which has been emplaced into the sedimentary rocks. The weathering of sulphide minerals, often found in coal bearing rocks, gives rise to the formation of AMD; which is further discussed in Section 5.

3.5 TOPOGRAPHY

The information summarised below was sourced from the visual specialist study and the faunal specialist study. For further information, please refer to the full reports which are included in Appendix O and Appendix I respectively.

3.5.1 INTRODUCTION

Topography refers to the surface shape and features of an area. The topography has the potential to be altered by the removal of the mineral resource from the study area. Possible changes to the current topography can occur which may impact on ground water, surface water drainage, visual character and the safety of both people and animals if not properly mitigated.

3.5.2 DATA COLLECTION

Data regarding the topography of the study area was sourced from the 1:50 000 scale topo-cadastral map. Warnock, S. & Brown, N. (1998) and Lynch, K. (1992) were utilised as source documents for descriptions of the topography of the site.

3.5.3 RESULTS

The study area lies between 1 450 and 1 600 m above sea level, with the highest point on the western boundary. The terrain falls gently to the east, with slopes of between 2% and 5% and is generally undulating throughout. The area is drained by tributaries of the Ngwempisi and Hlelo Rivers, which flow generally from west to east. The opencast area of the mine and its relevant infrastructure will have a minimal influence the baseline topography due to the limited nature of the invasive activities scheduled to take place.

3.5.4 CONCLUSION

The natural pre-mining topography falls gently to the east, with slopes of between 2% and 5% and is generally undulating throughout. The site also includes several stream beds and other depressions in the landscape, with dams occurring in several places. Opencast mining will impact on the topography of application area; however this is likely to be minimised due to mitigation measures that will be instituted during the process and during the rehabilitation phase.

3.6 CLIMATE

The information summarised in the section below was sourced from the air quality specialist study. For further information, please refer to the full air quality scoping report which is included in Appendix N.

3.6.1 INTRODUCTION

Climate can be defined as weather conditions that have occurred over a long period of time in an area. Dominant climatic features that climate is centred around are temperature, rainfall, wind and evaporation. These climatic features can affect the mining environment in a number of ways:

- Influence erosion;
- Influence vegetation growth, which affects rehabilitation planning;
- System monitoring of ground water balance/availability;
- Evaporation rates influence vegetation growth;
- Air temperature can influence air dispersion through atmospheric stability and mixing layers; and
- Wind speed and direction can influence erosion and the dispersion of potential atmospheric pollutants.

3.6.2 DATA COLLECTION

Fifth-Generation Penn State/NCAR Mesoscale Model (MM5) modelled meteorological data for the application area (26.866761°S; 30.308845°E) were used to generate wind roses based on 16 spokes, representing the directions from which winds blew during the period 2010 – 2012. A monthly-average ambient temperature trend was calculated using MM5 data, with the location of the theoretical MM5 station located in the centre of the proposed open pit. The long-term temperature trends recorded for Nooitgedacht Weather Station from 1951-1984 were considered to be representative of the proposed mine site. Nooitgedacht is located at 26° 31” S and 29°58” E, near the centre of Ermelo and is the nearest historical weather station available.

3.6.3 RESULTS

A description of the climate of the study area is based on the climate of the closest weather station, Nooitgedacht. The climate of the study area is typical of the South African Highveld with warm summers and cold winters. The rainfall associated with the Mpumalanga region is deemed Mediterranean. The majority of the annual average rainfall of 748 mm falls in summer (October to April). The extreme maximum temperature is 24.6°C and the extreme minimum temperature is 0°C. Fog occurs for an average of 20 days a year, generally in the winter.

Wind roses based on 16 spokes, representing the directions from which winds blew during the period 2010 - 2012 (**Figure 9**) were created for the study area. The colours reflect the different categories of wind speeds with the dotted circles indicating the frequency of occurrence. The flow field is dominated by winds from the east and east-north-east as well as the west and west-north-west. During day-time conditions, frequency of stronger winds from the west and west-north-west increases while winds from the north-east and east-north-east are more common at night.

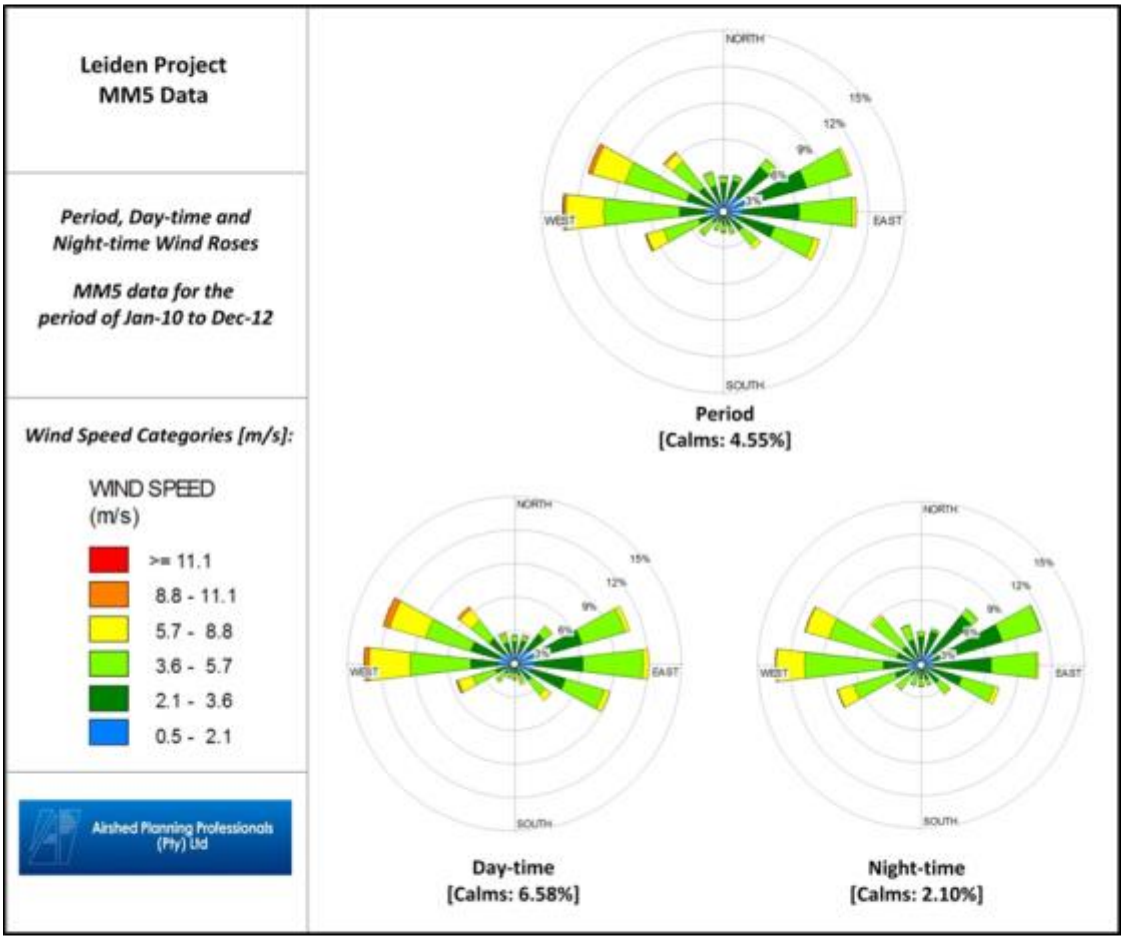


Figure 9: Seasonal variation in wind direction

Seasonal variation in wind direction is also evident (**Figure 9**) with winds from the west and west-north-west dominating during autumn and winter. Easterly winds are more frequent in summer and spring. Strong westerly's and west-north-westerly's occur during winter and spring.

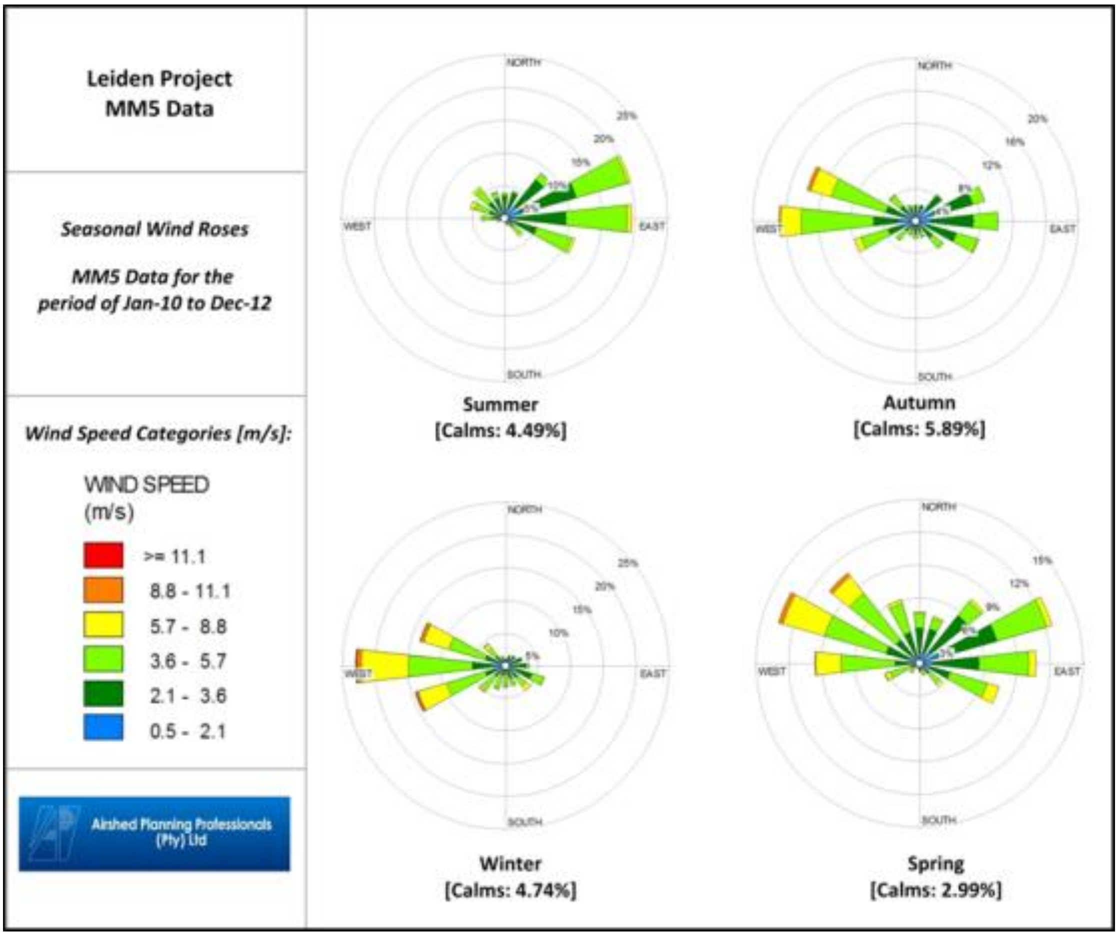


Figure 10: Monthly average ambient temperature trend

A monthly-average ambient temperature trend (**Figure 10**) shows temperatures typically range between 14°C and 24°C during summer months at the site, with daily-averages in the order of 18°C. During winter months, temperature ranges of between 3°C and 16°C are typical, with average temperatures of 8.3°C in June and 8.1°C in August.

The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness (Tiwary and Colls, 2010).

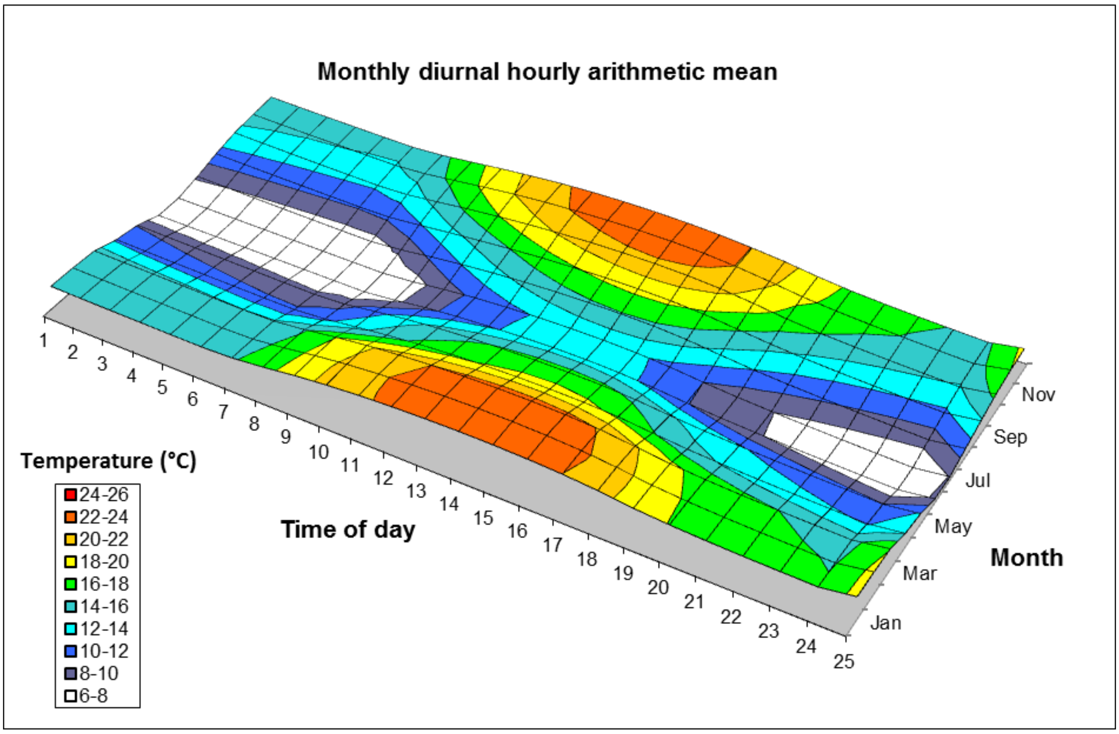


Figure 11: Monthly diurnal hourly arithmetic mean

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers (Tiwary and Colls, 2010). Temperature provides an indication of the extent of insolation, and therefore of the rate of development and dissipation of the mixing layer. The long-term temperature trends recorded for Nooitgedacht from 1951-1984 seen in **Table 5** were considered. Minimum long-term temperatures have been recorded as ranging from 0°C to 16.9°C with maximum temperatures ranging between 16.3°C and 24.6°C (**Table 5**). Mean temperatures, recorded over the long-term, ranged between 3.1°C and 16.9°C.

Table 5: The long-term temperature trends recorded for Nooitgedacht from 1951-1984

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Nooitgedacht	Max	24.6	24.3	23.6	21.2	18.9	16.3	16.8	19.5	22.5	23.2	23.2	24.2
	Mean	16.9	16.1	14.8	11.8	7.7	3.1	3.4	7.1	12.1	14.7	16.1	16.9
	Min	12.9	12.6	11.1	7.8	3.6	0	0	2.6	6.6	9.4	11.1	12.3

The rainfall associated with the Mpumalanga region is deemed Mediterranean. The long-term average total annual rainfall for Nooitgedacht is ~748 mm.

Table 6: Long-term average monthly rainfall (mm) for Nooitgedacht (1951-1984) (Schulze, 1986)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Nooitgedacht	123	84	69	48	17	7	9	13	30	90	134	134	748

Long-term monthly average rainfall data shows that rain falls mainly in summer from October to April (Table 6), with the peak being in December (Schulze, 1986). Between 2010 and 2012 MM5 modelled data shows higher than average annual rainfall, especially in January and December (Figure 12). While snow and hail are relatively rare, fog does occur in the vicinity of Nooitgedacht for an average of 20 days per year, especially in the winter months.

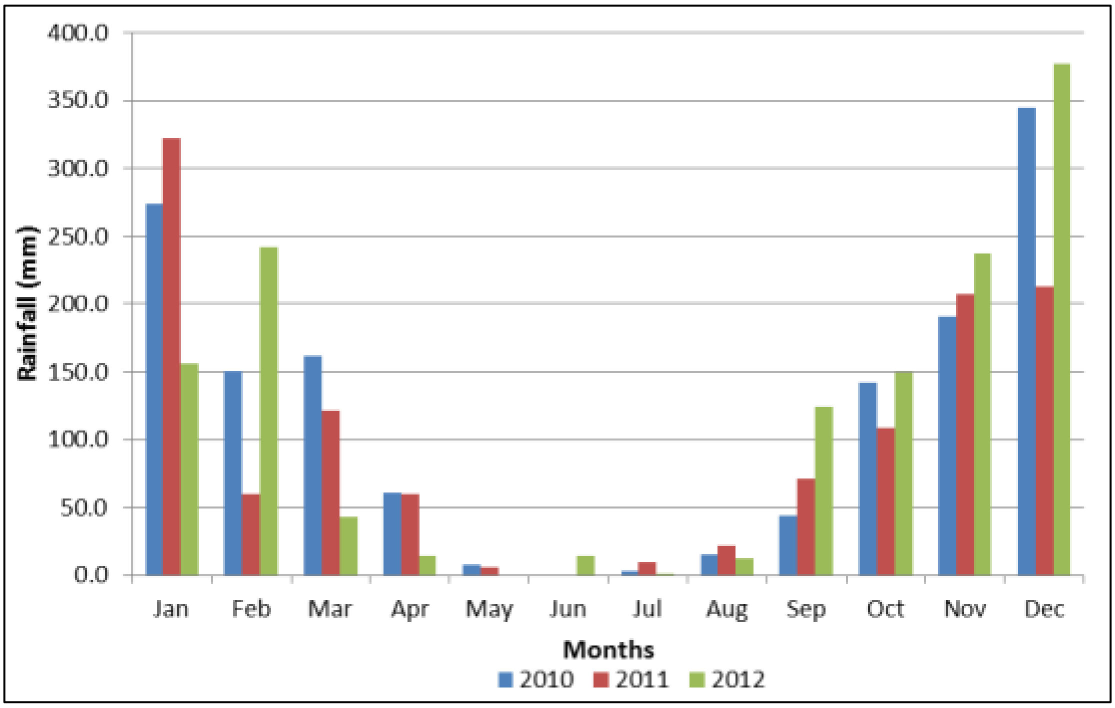


Figure 12: Long-term average total annual rainfall for Nooitgedacht

Figure 12 indicates that the site receives the majority of its rain during the summer months. December and January see the most rainfall in the summer with June and July the least rainfall occurring in the winter months. December 2012 yielded the highest rainfall in the dataset at over 350 mm. The lowest rainfall represented was 0 mm for May 2012, June 2010 and 2011.

3.6.4 CONCLUSION

The overall climate in the study area is typical of the South African Highveld with warm summers and cold winters. High evaporation rates reduce infiltration rates, while the high rainfall levels can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however allow for surface infiltration thereby reducing the effects of erosion. The mixing of atmospheric layers resulting in the formation of temperature inversion and the presence of cloud cover limits the dispersion of pollutants into the atmosphere. These climatic aspects need to be taken into consideration during rehabilitation and surface water management planning.

3.7 SOILS

The Agricultural Research Council Institute for Soil, Climate and Water (ARC-ISCW) was appointed by EIMS to undertake the soils, land use, and land capability specialist study for the Leiden project. The following sections provide a summary of the soil environment that may be affected by the proposed Leiden project. Information has been sourced from the Soils, Land Use and Land Capability EIA Report. For further information, please refer to the full Soils Impact Assessment Report which is included in Appendix G.

3.7.1 INTRODUCTION

Soils are an important component of most ecosystems. It can be considered an ecological driver and is the medium in which most vegetation grows and a range of vertebrates and invertebrates exist. From a mining perspective, soil is even more significant as mining is a temporary land use where after rehabilitation (using soil) is the key to re-establishing post closure land capability that will support post closure land uses.

Mining projects have the potential to damage soil resources through physical loss of soil and/or the contamination of soils, thereby impacting on the soils ability to sustain natural vegetation and altering land capability. The contamination of soils may contribute to the contamination of surface and groundwater resources. Loss of the topsoil resource reduces chances of successful rehabilitation and restoration.

3.7.2 DATA COLLECTION

Data sources for the assessment included the existing map sheet 2630 Mbabane (Schoeman and Fitzpatrick, 1979) from the National Land Type Survey (published at a 1:250 000 scale), together with a small scale site visit during which auger samples were collected. The soils are classified according to MacVicar *et al.* (1977).

For the EIA phase of the project, only 96 hectares around the identified surface infrastructure site, was investigated using a hand-held soil auger at a grid of observation of 150 x 150 m, to a maximum depth of 1 200 mm. At each soil observation point, the most important soil characteristics, such as colour, texture, structure, presence or absence of coarse fragments and soil drainage character, was described and noted. The soils were classified according to the South African Soil Classification System (Soil Classification Working Group, 1991). Similar soils were then grouped into map units.

Samples of topsoil and subsoil were collected at two locations and the soil was analyzed at the laboratories of ARC-ISCW for particle size (sand, silt and clay), cation exchange capacity and exchangeable cations (Ca, Mg, K, Na), pH (H_2O) and organic carbon.

3.7.3 RESULTS

A land type is defined as an area with a uniform terrain type, macroclimate, and broad soil pattern. Information obtained from the Land Type Survey (Schoeman & Fitzpatrick, 1976) indicated that the area is dominated by yellow-brown, structure less soils (land type Bb35). The soil varies slightly from sandy loam to sandy clay loam and the effective depth also varies somewhat, generally between 600 mm and 1200 mm. Small areas of the study area are dominated by shallow soils and a few surface outcrops. The prevailing agricultural potential of the area is moderate to high. The majority of the soils on site have an average effective soil depth of 800 mm or more which is more than adequate for agricultural activities. The application area under investigation, based on a desktop survey, is covered by two land types, namely Bb35 and Fa162. The distribution of the land types occurring in the study area is shown in Figure 13.

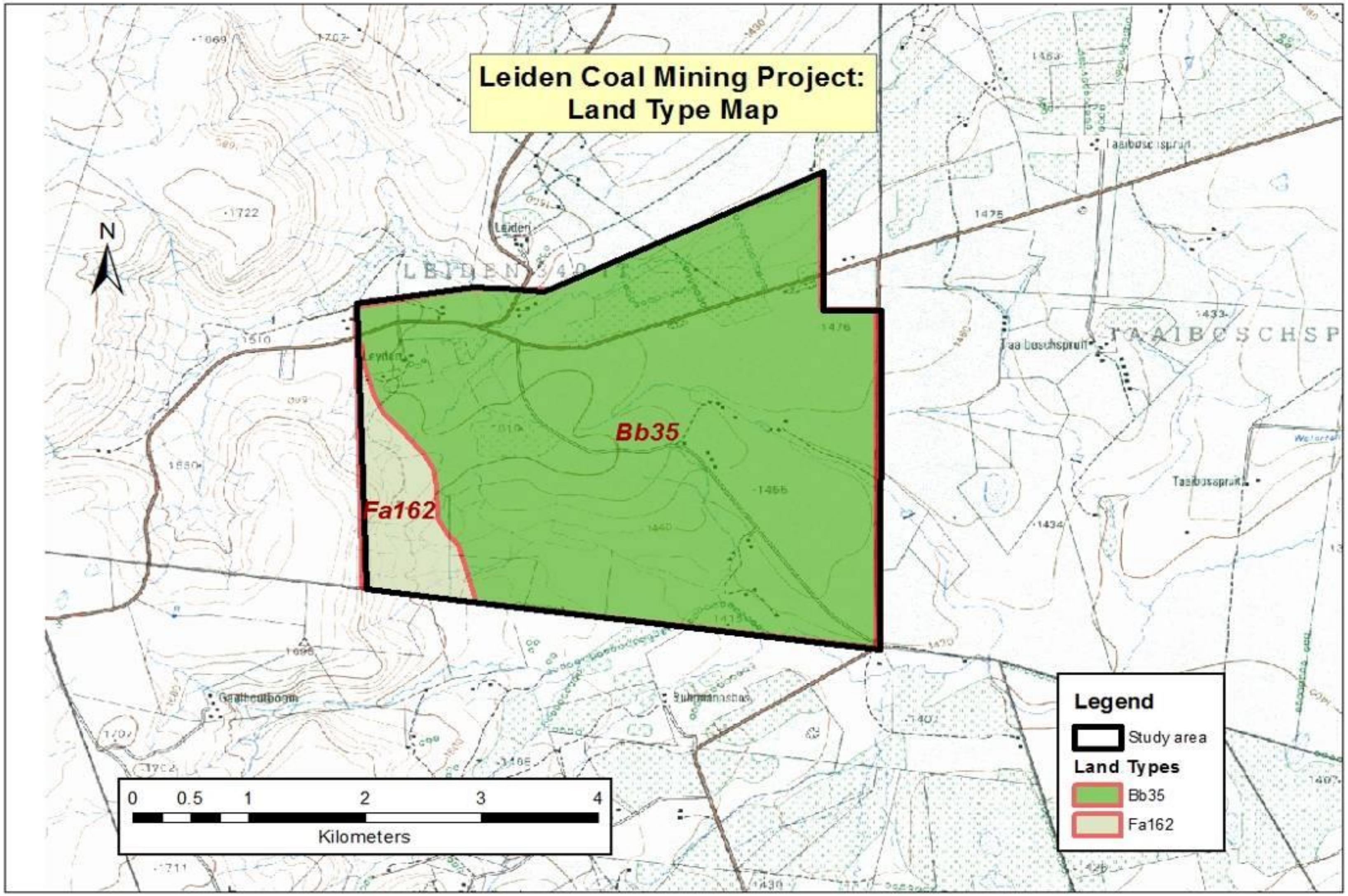


Figure 13: Land type map, Leiden Coal Mining Project

Table 7 below indicates the soils in order of their dominance on the site.

Table 7: Dominant soil types and their respective characteristics

Land Type	Dominant Soils	Depth (mm)	Percentage of Land Type	Characteristics	Agricultural Potential (%)
Bb35	Clovelly 16/17/18	450-900	18%	Yellow-brown, structureless, sandy clay loam soils on weathering rock	High: 29.6 Mod: 21.5 Low: 48.9
	Hutton 17/18 + Griffin 12/13	600-1200	16%	Red-brown to yellow-brown, structureless, sandy clay loam soils, on weathering rock	
	Avalon 16/17	600-1200	13%	Yellow-brown, structureless, sandy clay loam soils on mottled, soft plinthite	
Fa 162	Mispah 10 + Glenrosa 16/17	200-450	25%	Grey-brown, structureless, sandy loam to sandy clay loam topsoils on hard to weathering rock	High: 4.6 Mod: 2.2 Low: 93.2
	Rock	-	25%	Surface outcrops	
	Hutton/Clovelly 16	400-600	15%	Red-brown to yellow-brown, structureless, sandy clay loam soils, on hard to weathering rock	

3.7.3.1 Site Sensitivities and Constraints

In terms of the soils on site, the only area that can be assessed as high sensitivity will be the wetland occurring to the south of the planned infrastructure area, while all the other areas can be regarded as low sensitivity. There are no site constraints from a soils perspective.

3.7.4 CONCLUSION

The site is dominated by yellow-brown, structure less soils. The wetland soils on site have been identified as most sensitive and impacts to these areas would not be easily mitigated. The rest of the soils are classified as low sensitivity in relation to wetland soils, although these soils are generally moderately deep to deep, with a moderate to high potential for agricultural production. These are therefore still valuable soils and it will be imperative to ensure that they do not become disturbed or degraded to any excessive degree otherwise rehabilitation of the area post mining could become problematic.

3.8 LAND USE

The Agricultural Research Council Institute for Soil, Climate and Water (ARC-ISCW) was appointed by EIMS to undertake the soils, land use, and land capability specialist study for the Leiden project. The following sections provide a summary of the land uses that may be affected by the proposed Leiden project. Information has been sourced from the ARC-ISCW EIA report. For further information, please refer to the full soil EIA report (Appendix G) and vegetation assessment report (Appendix H).

3.8.1 INTRODUCTION

Each land use of an area has an inherent value based on the employment and income it generates. Mining activities have the potential to affect land uses both within the surface use area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. The key related impacts include loss of soil, loss of biodiversity, pollution of water, dewatering, air pollution, noise pollution, and damage/destruction from blasting.

3.8.2 DATA COLLECTION

The land use for the project application area was deduced by means of site visits undertaken on the 3rd and 16th September 2013 by ARC-ISCW and SPEC respectively. During the first of these site visits a visual inspection and survey was completed, confirming the land type described by Schoeman & Fitzpatrick (1979). Land uses were also identified and discussed with the landowner during a meeting with Equispectives Research and Consulting Services.

3.8.3 RESULTS

The proposed area for mining lies immediately to the east of the south-eastern Mpumalanga escarpment. To the west, above the escarpment, the dominant land use is grazing land, with occasional areas of dry land cultivation. Below the escarpment are more favourable soils where commercial forestry plantations take place, extending to the east and north-east.

The results of the study determined that forestry plantations occur in most of the higher-lying parts of the study area. Closer to the stream beds, and especially in the wider valley floors in the north and south of the study area, grassland (either natural or cultivated pastures) occur, presumably because the soils are too wet for sustainable tree growth.

Figure 14: **Land Use** provides a representation of the different land uses that are found to occur within the study site, namely:

- Forest Plantation;
- Wilderness (consisting of grasslands and wetlands);
- Built-up Land; and

- Vacant (Old Fields).

Although the aforementioned land uses compete for space, there will be co-existing land uses occurring within the project application area.

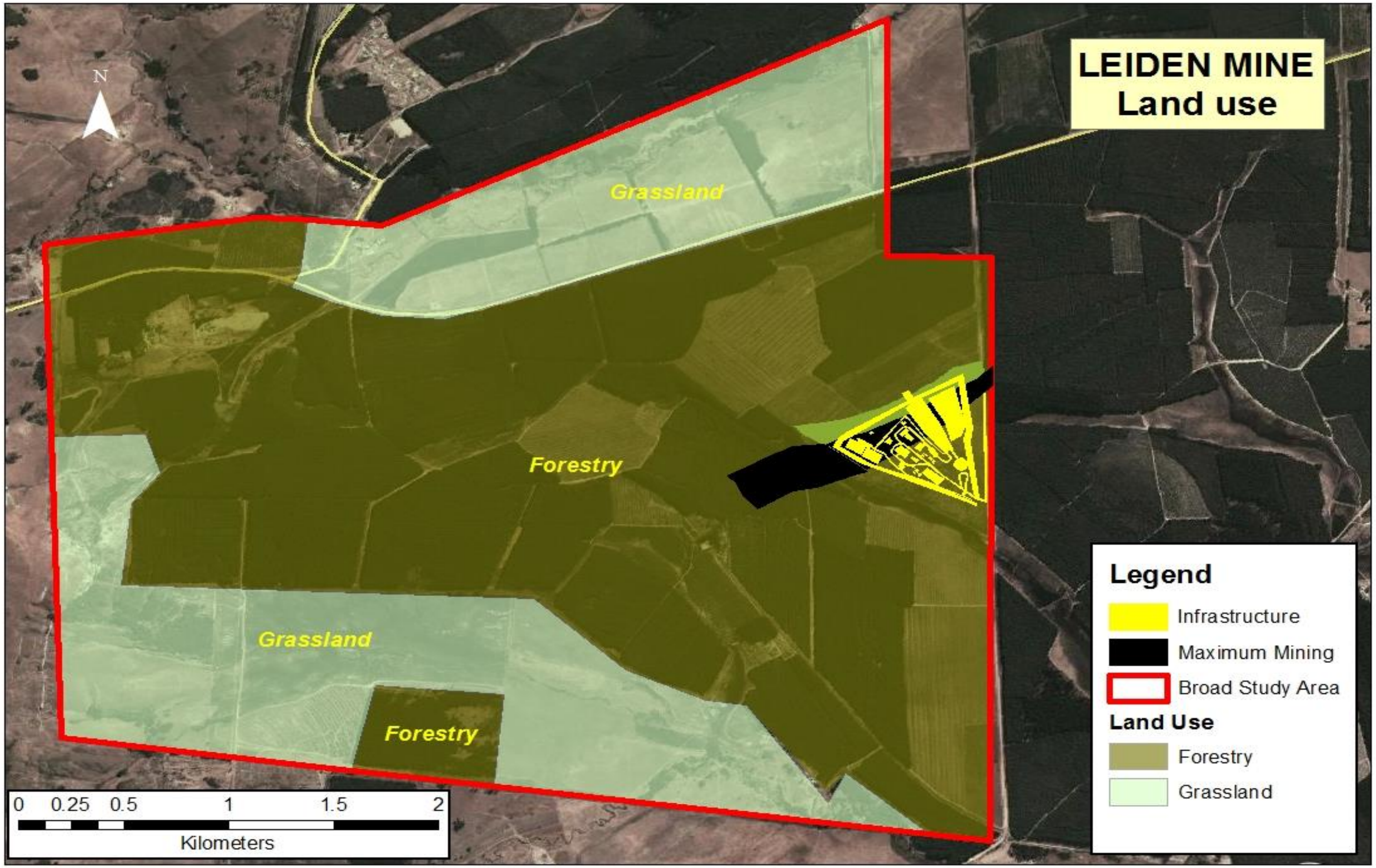


Figure 14: Land Use

3.8.4 CONCLUSION

Several land uses are present on the site, with various levels of disturbance included. The predominant land use at present is forestry followed by wilderness and vacant land including old fields. Coal deposits are prevalent across the study area deeming it potentially minable. Mining operations often conflict with existing land uses and therefore the proposed mine has the potential to affect the current land use and negatively affect it.

3.9 LAND CAPABILITY

The Agricultural Research Council Institute for Soil, Climate and Water (ARC-ISCW) was appointed by EIMS to undertake the soils, land use, and land capability specialist study for the Leiden project. The following sections provide a summary of the land capability that may be affected by the proposed Leiden project. Information has been sourced from the ARC-ISCW EIA report. For further information, please refer to the full soil EIA report which is included in Appendix G.

3.9.1 INTRODUCTION

It is important to adopt a holistic approach towards the land capability of the study area in order to recognize how the area will possibly be affected by the Leiden Coal Mine. The land capability classification is based on the soil properties and related potential to support various land use activities. Arable land was identified as the dominant land capability class. The land capability is expected to vary with certain soils having a higher potential for arable cultivation. Mining operations have the potential to significantly transform the land capability, often irreparably. The types of impacts related to land capability involve post mining compaction, loss of fertility, impeded soil drainage and insufficient depth of the replaced soil. In many cases, mining may result in the land capability class would change from arable to grazing post closure.

3.9.2 DATA COLLECTION

The data used in this study was obtained from Schoeman & Fitzpatrick (1979) and was used together with a site visit and soil sampling results to determine the pre-mining land capability of the Leiden Coal Mine area.

3.9.3 RESULTS

Plantation forestry, grasslands, wetlands and wilderness areas were pre-identified land capabilities that could be affected by mining operations. The soils occurring in the study area are generally moderately deep to deep, with a moderate to high potential for agriculture, although the prevailing land use is forestry (which also requires deep soils). The land capability is influenced by factors such as rainfall in the area and the soil depth. Where the natural drainage regime of the soil is disturbed, waterlogging can occur in previously freely-drained environments, both as a result of soil compaction and that caused by changes in the underlying material. This in turn can result in changes to land capability. It will therefore be critical to try and ensure that the prevailing topography, with associated drainage aspects, is retained, so that the natural soil drainage patterns are disturbed as little as possible.

The pre-mining land capability, as defined by the relevant guidelines (Coaltech, 2007), identifies the soils as falling into the arable class, due to their favourable depth, texture and natural drainage. The dCv map unit (See Figure 15 below), being deeper, will have a higher arable capability than the mGc map unit. The Ka unit consists of soils in the land capability class of wetland (although this unit occurs outside of the area proposed for infrastructure). Virtually the whole application area (all the non-wetland areas) can be classed as arable, despite the fact that forestry is the prevalent land use. The grazing capability by livestock is predicted to be high with around 6-8 ha per large stock unit (Schoeman & van der Walt, 2004).

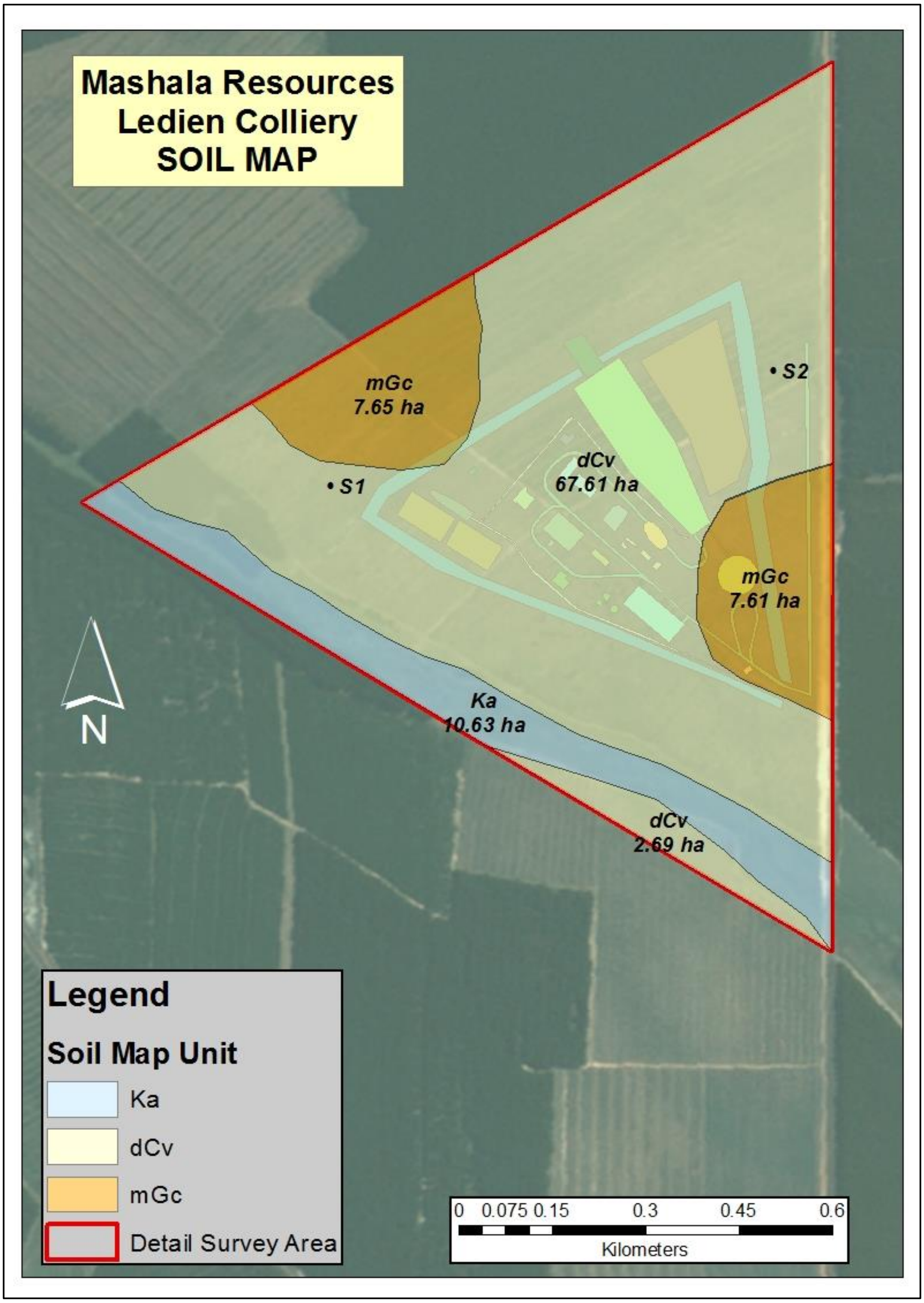


Figure 15: Detail soil map

3.9.4 CONCLUSION

Mining operations may change the land capability, potentially limiting the extent of the forestry due to the changes in the soil (depth, compaction, drainage etc.).The land capability is considered to be arable throughout the study area. Currently the predominant land use is plantation forestry, although the soil fertility is generally good and land capability is therefore relatively high and may support other land uses. It is notable however that very little agricultural activity takes place in the greater area.

3.10 FLORA

Spatial Ecological Consulting (SPEC) was appointed by EIMS to undertake the vegetation assessment specialist study for the Leiden project. The following sections provide a summary of the vegetation that may be affected by the proposed Leiden project. Information has been sourced from the SPEC EIA report. For further information, please refer to the full vegetation assessment EIA report which is included in Appendix H.

3.10.1 INTRODUCTION

Vegetation is a key component of ecosystems for a number of reasons. Vegetation forms the foundation of the food web as well as providing both habitat and food for animals. Many plant species also hold cultural, medicinal or spiritual meaning to certain communities. The plantations associated with the project application area also provide a source of income.

The mining activities and the establishment of the supporting infrastructure have the potential to result in loss of vegetation, habitat disruption, loss of ecosystem functionality, habitat transformation, spread of alien invasive species and ultimately a reduction in overall biodiversity.

3.10.2 DATA COLLECTION

The data used in this vegetation study was collected from a number of sources to provide a clearer view of the vegetation on site. Data was acquired from Mucina and Rutherford (2006) together with a desktop analysis and two site visits were undertaken (September 2013 and April 2014) to establish a baseline for the area. The site visit conducted in 2014 focused on the proposed open cast mining and infrastructure areas as well as the proposed underground mining site. Species lists were derived from a quarter-degree search of the site and project application area was also utilized from the biodiversity information database SIBIS (http://sibis.sanbi.org/) and compared to the South African plant Red Data list and the NEMBA threatened and protected species list.

3.10.3 RESULTS

The majority of the study area falls within the Eastern Highveld Grassland vegetation type, which is classified as Endangered by Mucina and Rutherford (2006) and as Vulnerable in the NEMBA list (2011). The south-west corner of the site falls within the Wakkerstroom Montane Grassland vegetation type, which is classified as Least Threatened, although very little of it is formally protected (Mucina & Rutherford 2006). These classes/rankings are important as they assist in determining the area’s floral sensitivity.

A number of broad vegetation communities were identified on site:

- Plantations (Alien species);
- Primary vegetation (Primary grasslands and Primary rocky grassland);
- Old fields (Disturbed); and
- Wetland vegetation.

Several threatened species were recorded in the area after the site visit was undertaken. The species identified on site are indicated in Table 8. Some of the species may potentially be present in the western portion of the site in hill grassland vegetation unit, but only one species, *Eucomis autumnalis*, may potentially occur close to the proposed mining activities in the temporary zone of the wetland. The habitat is however not ideal for the species.

Table 8: Threatened species recorded in the area

Scientific name	Conservation RSA	MTPA	Endemic	Farm	Habitat	Habitat present
Jamesbrittenia macrantha	NT	NT	SA	**ALKMAAR 320 IT**	Grassy slopes with other scattered shrubs, restricted to norite.	No
Asclepias bicuspis	CR	CR	SA	**LEIDEN 340 IT**	Mistbelt grassland, in well-drained soil in annually burned grasslands, including firebreaks, 1 200-1 500 m.	None observed, habitat in hill grassland
Barleria natalensis	Ex	Extinct in KZN	SA	**LEIDEN 340 IT**	Coastal grassland, 100 m.	No
Eucomis autumnalis	Declining	Declining	FSA	**LEIDEN 340 IT**	Damp, open grassland and sheltered places from the coast to 2450 m.	None observed, habitat in temporary zones of the wetland areas.
Merwilla plumbea (=Scilla natalensis	NT	NT	FSA	**LEIDEN 340 IT**	Montane mistbelt and Ngongoni grassland,	None observed, habitat

Scientific name	Conservation RSA	MTPA	Endemic	Farm	Habitat	Habitat present
)					rocky areas on steep, well drained slopes. 300-2500 m.	in hill grassland
Eulophia parvilabris	LC	Rare	Not	**TAAIBOSCHSPRUIT 343 IT**	Higher altitude grassland. Mountainsides along forest edges, near edge of wetlands, at bottom of rock faces and in sheltered valleys. Mostly in full sunlight. Individuals widely dispersed.	None observed, habitat in hill grassland

A few species protected under the Mpumalanga Nature Conservation Act, mostly bulbous species, were observed on site and are included in Table 9 below. A permit is required to remove or move these species on site.

Table 9: Protected species observed on site

Species	Grass and sedge wetland			Secondary vegetation			Primary vegetation	
	Wetland south	Wetland south tributary	Wetland east	Secondary grassland	Planted pasture	Planted fruit/nut trees	Primary rocky grassland	Primary grassland
Agapanthus species	x							
Aloe species				x				
Crinum species				x				
Cyathea species							x	
Gladiolus species				x				x

Several invasive species listed under Conservation of Agricultural Resources Act (CARA, 1983) and the Mpumalanga Nature Conservation Act were observed on site. The invasive species observed on site are listed in Table 10 below.

Table 10: Invasive species identified on site

Species	Growth form	CARA category	Mpumalanga
Acacia dealbata	Tree	2	Y
Acacia decurrens	Tree	2	Y
Acacia mearnsii	Tree	2	Y
Acacia melanoxylon	Tree	2	Y
Arundo donax	Grass	1	Y
Bidens pilosa	Forb		Y
Cirsium vulgare	Forb	1	Y
Datura stramonium	Shrub	1	Y
Eucalyptus species	Tree	2	
Pennisetum clandestinum	Grass	X2	
Pinus species	Tree	2	
Populus alba	Tree	2	
Rubus cuneifolius	Shrub	1	Y
Rumex crispus	Forb	X3	
Salix babylonica	Tree	2	
Solanum mauritianum	Forb	1	Y
Solanum sisymbrifolium	Forb	1	

Several medicinal plants were observed on site, even though it is unlikely that the medicinal species are utilised on site. Medicinal plants include common and rare species, as well as invasive plant species, such as *Datura stramonium*. The medicinal species recorded on site are included in Table 11 below.

Table 11: Medicinal species recorded on site

Species	Alien sp	Wetland north	Wetland south	Wetland E centre	Secondary grassland	Primary vegetation
Agapanthus species			x			
Aloe species					x	
Crinum species					x	
Datura stramonium	Y				x	
Dicoma cf anomala					x	
Euclea undulata						x
Helichrysum aureonitens						x

Species	Alien sp	Wetland north	Wetland south	Wetland E centre	Secondary grassland	Primary vegetation
Helichrysum nudifolium		x	x			x
Helichrysum rugulosum		x				
Helichrysum species			x		x	x
Hypoxis species			x		x	x
Pelargonium luridum			x			x
Rumex crispus	Y		x			
Scabiosa columbaria					x	
Senecio species		x	x			
Thesium species					x	x
Typha capensis		x		x		

According to the Mpumalanga C-Plan (Ferrar & Lötter, 2007) seen below in Figure 16, most of the site has no natural habitat remaining. The rest of the site is located in areas indicated to be Least Concern or Important and Necessary. The Highly Significant and Important and Necessary habitats are mostly located in the portion of primary vegetation and wetland vegetation remaining within the study area. There are therefore a few portions of vegetation on site that are important for protection of the biodiversity of Mpumalanga.

3.10.3.1 Site Sensitivity and Constraints

The key site sensitivities identified of site were vegetation groups with a high sensitivity, namely Primary vegetation (Primary grassland and rocky hill grassland and ravine thickets), and wetland vegetation such as Grass and sedge wetland. There were no site constraints that were identified for Alternative 1 and 3 although some cumulative impacts are present. Primary vegetation is present in the wetland area proposed during the open cast mining activities in Alternative 2. This vegetation can only be restored if the hydrology of the site is reinstated correctly.

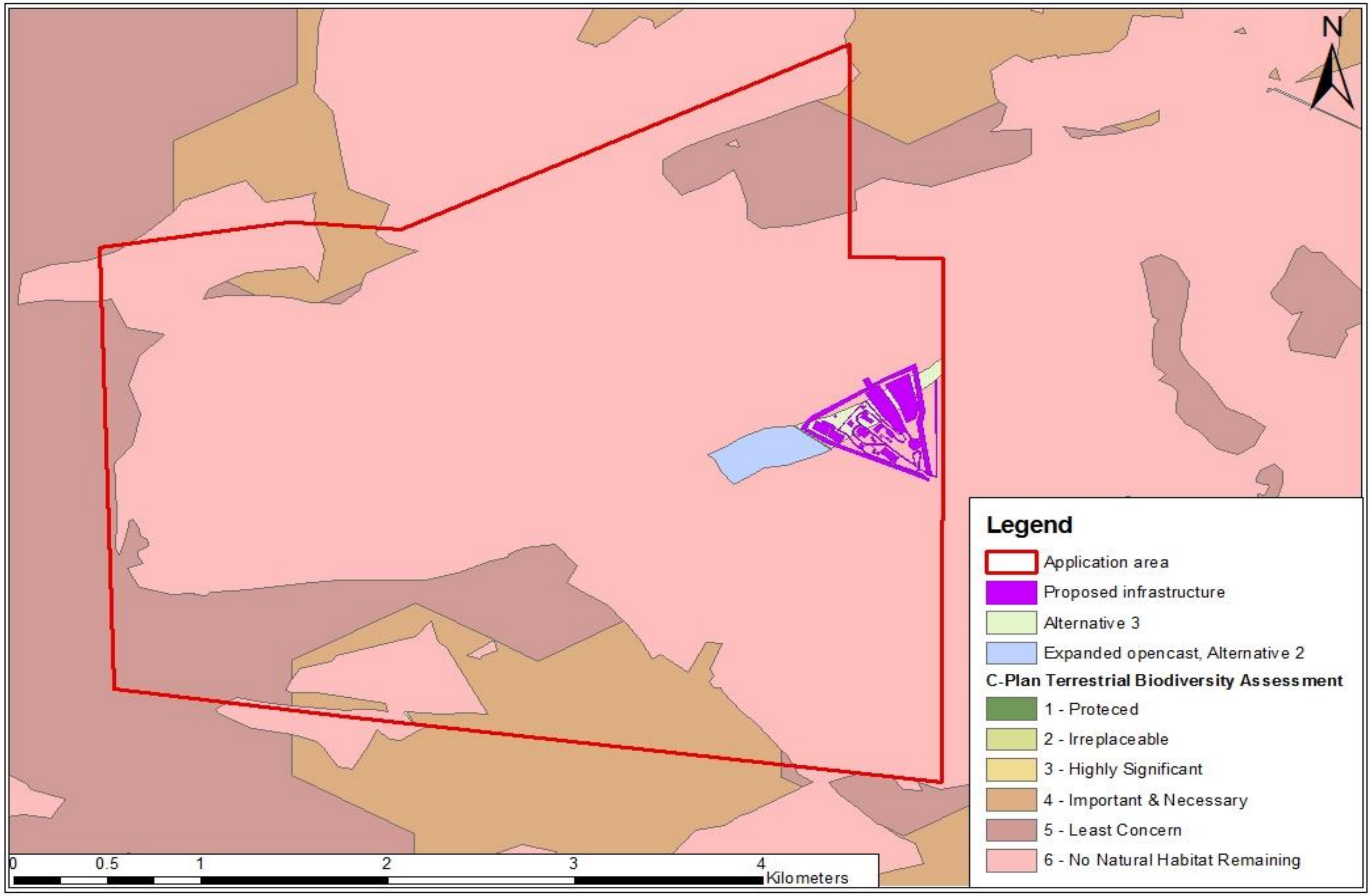


Figure 16: Important terrestrial areas according to the Mpumalanga C-Plan

3.10.4 CONCLUSION

The site includes vegetation communities falling within threatened and protected vegetation types. Portions of the site are listed under the Mpumalanga C-Plan as Important and Necessary habitats. The site may also have a number of plant species protected under the National Environmental Management: Biodiversity Act or the Mpumalanga Nature Conservation Act. Portions of the site may therefore be of moderate or high sensitivity and mining has the potential to impact these areas negatively. Some of these impacts are preventable in certain areas, while others may be mitigated to varying degrees.

3.11 FAUNA

David Hoare Consulting cc was appointed by EIMS to undertake the fauna specialist study for the Leiden project. The following sections provide a summary of the fauna that may be affected by the proposed Leiden project. Information has been sourced from the fauna EIA report. For further information, please refer to the full fauna EIA report which is included in Appendix I.

3.11.1 INTRODUCTION

Fauna may be directly or indirectly affected by the mining operations and related activities. As a result, sections of habitats may be damaged or negatively influenced. Sensitive faunal habitats are by their very nature, highly complex. The establishment of infrastructure and mining operations have the potential to result in damage to habitat, loss of biodiversity, the introduction of foreign animals, direct and indirect mortality of animal species, and the loss of or damage to sensitive and protected species.

3.11.2 DATA COLLECTION

Faunal data for the study was collected in a number of different ways. A desktop study was used to identify issues that might arise with respect to a significant species, rare habitats, and processes. Literature on animal species distribution and IUCN Red List Data was used to a large extent to determine the species on site for the project area in the form of a habitat review. A site visit was also completed to familiarise the consultant with the site, the scale of the project and to determine the appropriate field programme for the area.

3.11.3 RESULTS

Wetlands and drainage lines, ridges, and intact patches of connected grassland; irrespective of their ecological condition, represent the most sensitive faunal habitats present within the Application area. A land cover map (Fairbanks *et al*. 2000) of the study site was used to indicate that a large proportion of the site consists of forestry plantations, except for a band of natural grassland vegetation running in an arc along the western boundary of the site. The literature investigation provided information regarding the sensitive species that could possibly occur on site. These species are briefly discussed below.

The five sensitive mammal species identified as having a probability of occurring on site are the Brown Hyaena, the Spotted-necked Otter, the Honey Badger, Temminck's Ground Pangolin, and the White-tailed Rat. None of these species are at risk from the proposed project; either due to the fact that they are mobile enough not to be affected by activities on site or the habitats that they could potentially occur in will not be affected. The project application area contains no unique or important mammalian habitats and no mammal species are likely to be significantly negatively impacted by development of mining on site.

Habitat found within the area supports a number of frog species, although none have been identified as being sensitive. The Giant Bullfrog is the only frog, potentially occurring within the area,that has been listed in a threat category. However, based on the geographical distribution of this species, the Giant Bullfrog is unlikely to occur on the site. There are therefore no frog species of conservation concern that may be expected to be negatively impacted by the proposed activities.

A total of 64 reptile species have a geographical distribution that includes the general study area in which the site is found. Of these, the species of concern which may occur in the area include the Southern African Python, Striped Harlequin Snake, Yellow-bellied House Snake, and Swazi Rock Snake. Two of these reptile species of concern are anticipated to potentially occur within the site, namely the Striped Harlequin Snake and Yellow-bellied House Snake, both of which are listed as Near Threatened.

A total of 343 bird species have a geographical distribution that includes the general study area in which the site is found. Of particular concern are those species that may be resident on the site, i.e. use the site for more than foraging. A number of such species are expected to occur within the site, including the Blue Crane, Grass Owl, Short-tailed Pipit, Southern Bald Ibis, Striped Flufftail, Denham's Bustard, Yellow-breasted Pipit, Blackwinged Lapwing, Blue Korhaan, Crowned Eagle, Lanner Falcon, and Secretary bird. This species list is not comprehensive and other bird species of conservation concern may also be affected by activities on the site. A number of the bird species with a geographical distribution that includes the project area have been listed in the Eskom Red Data Book of the Birds of South Africa, Lesotho and Swaziland. It is possible that some of these species are likely to be negatively impacted by the development of mining in the application area.

Twelve species of concern were identified that may be negatively affected by development of the site, the Blue Crane (VU = Vulnerable), Grass Owl (VU), Short-tailed Pipit (VU), Southern Bald Ibis (VU), Striped Flufftail (VU), Denham's Bustard (VU), Yellow-breasted Pipit (VU), Black winged Lapwing (NT = Near Threatened), Blue Korhaan (NT), Crowned Eagle (NT), Lanner Falcon (NT), and Secretary bird (NT).

Significant habitat for faunal species on the site is lowlands with water bodies, wetlands or marsh areas, as well as any adjacent grassland areas. Plantation forests can also support populations of sensitive species, especially small raptors.

3.11.3.1 Site Sensitivity and Constraints

Areas within the Leiden project area that are classified as having VERY HIGH and HIGH sensitivity are natural areas, particularly wetlands, drainage lines and adjacent grasslands, as well as mountain grassland. These areas are potentially restricted in terms of development footprints (require mitigation to offset impacts), areas classified as having LOW sensitivity are negotiable and remaining areas are preferred as sites for potential development. The proposed mining infrastructure is located within areas classified as having LOW sensitivity

The potential site constraints identified are populations of species of concern that are likely to occur on site are birds that will disperse in the face of construction activities. The area potentially affected by the proposed mining activities does not constitute important habitat for any of these species.

3.11.4 CONCLUSION

There are a number of animal species of conservation concern that may occur in habitats within the study area. The loss of related habitats may result in negative effects for these species. However, most of the species are mobile animals that are likely to move away from the path of any development. The development of the site is therefore highly unlikely to have a noticeable negative effect on the species currently present in the study area.

3.12 SURFACE WATER

GCS Water and Environmental Consultants was appointed by EIMS to undertake the surface water specialist study for the Leiden project. The following sections provide a summary of the surface water resources that may be affected by the proposed Leiden project. Information has been sourced from the WCS EIA report. For further information, please refer to the full surface water EIA report which is included in Appendix J.

3.12.1 INTRODUCTION

Surface water resources includes rivers, streams, drainage lines, flow paths of storm water runoff, as well as water collection and channelling through the use of irrigation furrows, canal, channels, and dams. Mining activities have the potential to alter surface water drainage patterns through actual mining methods employed as well as the placement of infrastructure. In addition, these activities also have the potential to result in the pollution and/or contamination of surface water resources through geological exposure, seepage, spillages and waste streams both mineralised and non-mineralised.

3.12.2 DATA COLLECTION

The data was collected in a number of different ways to formulate an understanding of the project area. The desktop portion of the study utilized generally-accepted algorithms and methodologies to determine design floods at various points in the area, to estimate flood depths. Runoff from the various streams was analysed by using accepted techniques, such as ARC-View and ARC-GIS for Geographic Information Systems work and mapping (ESRI, 2012) and UPD (Alexander W., 2002). The SANRAL Drainage Manual (SANRAL, 2007) was used for flood determination to downscale quaternary catchment data. Base-line runoff data was obtained from WRSM (as published in WR 2005: Water Resources of South Africa; WRC Reports TT 380 to 382/08) were used for (WRC, 2005). Literature utilised for baseline data also included the South African Weather Service (SAWS) and/or databases of WR2005 and 20m contour data was obtained from RSA National Geospatial Institute 1:50 000 Topographical Series: map code 2630CB. A site visit was undertaken in 9th October 2014 to confirm results from the desktop study and to provide additional baseline surface water information.

3.12.3 RESULTS

The project application area straddles the watershed between Quaternary Catchments W52A and W53A. The catchments which are located in the upper regions of the Ngwempisi River (W53A) to the north and Hlelo River (W52A) to the south are moderately disturbed.

A large inter-basin water transfer scheme releases some 45 million cubic meters of raw water into the Ngwempisi River. This water flows down the slightly modified watercourse of the Ngwempisi River, through the northern section of the study area.

W52A and W53A quaternary catchments which fall into the Mfolozi/Pongola catchment are reported as having average rainfalls of 836 mm in W52A and 825 mm in W53A per annum (W53A is a larger catchment that extends further away from the escarpment). The Mean Annual Runoff is approximately 102 mm, but simulations to assess the impact of forests indicate that this value is likely to reduce to 61 mm in afforested areas. Rainfall will be distributed according to WR 2005 Rain Zone W5C, and annual Symons Pan evaporation of 1400 mm will correspond to Evaporation Zone 13A.

3.12.3.1 Downstream Water Demands

Both quaternary catchments fall within the W50 (Usuthu River Basin) drainage area, which constitutes an internationally shared basin and will be subject to existing treaties that govern releases and water quality at the Swaziland border. The Usutu catchment is characterised by large transfers out of the catchment (and out of the Water Management Area (WMA)) to the Vaal system and the Olifants WMA for cooling purposes at power stations. The only significant in-basin use is afforestation with an estimated area of 1 930 km^2, making this catchment the most afforested in the WMA. The water requirements of Swaziland are an important factor in this catchment, and, unlike the Pongola catchment, international agreements with Swaziland and Mozambique do not allow much, if any, scope for further development in this catchment. The joint Maputo Basin Study will however identify possible joint development opportunities which could involve developing the resource in the upper Usutu for joint utilisation with Swaziland (DWA, 2004).

It is accepted that 50% of natural base-flow for the rivers should be available at the downstream border of Swaziland, and that water should at least meet South African SANS standards for irrigation water. Baseline water quality analyses derived from water samples taken during the site visit indicate reasonably good water quality (see Table 12).

Table 12: Base line water quality

Analyses in mg/ℓ (Unless specified otherwise)	Method Identification	SAWQT V Drinking Water	SANS 241: 2011	Sample Identification: Leiden Coal		
				WETUP	WETDS	PipeDS
Sample Number				17934	17935	17936
pH – Value at 25°C	WLAB001	6-9	5-9.7	7.2	7.1	7.9
Electrical Conductivity in mS/m at 25°C	WLAB002	<70	<170	20.1	53.1	12.4
Total Dissolved Solids at 180°C *	WLAB003	<450	<1200	134	376	108
Total Acidity as $CaCO_3$*	WLAB022	NS	NS	24	12	8
Total Alkalinity as $CaCO_3$	WLAB007	NS	NS	104	24	44
Chloride as Cl	WLAB046	<100	<300	5	5	5
Fluoride as F	WLAB014	<1	<1.5	<0.2	<0.2	<0.2
Nitrate as N	WLAB046	<6	<11	<0.2	<0.2	0.2
Nitrite as N	WLAB046	<1	<0.9	<0.1	<0.1	<0.1
Sodium as Na	WLAB015	<100	<200	7	12	6
Potassium as K	WLAB015	<50	NS	3.9	5.1	1.7
Calcium as Ca	WLAB015	<32	NS	15	46	9
Magnesium as Mg	WLAB015	<30	NS	11	29	5
Aluminium as Al (Dissolved)	WLAB015	<0.15	NS	<0.100	<0.100	1.47
Iron as Fe (Dissolved)	WLAB015	<0.1	2	0.531	<0.025	1.22
Manganese as Mn (Dissolved)	WLAB015	<0.05	0.5	<0.025	<0.025	<0.025
% Balancing	---			95.4	98.1	99.1

It is suggested that these samples should define future water quality objectives for rivers and streams below the project application area. To date, no current regional water conservation or management plans will impact directly on the proposed mining development.

3.12.3.2 Flood Flows

Flood flows from the 1:50 and 1:100 year rainfall storm events were calculated for the three natural catchments within the application area (see Table 13). Calculations were based on current conditions which represent control conditions in the three catchments.

Within catchment 2 of project area, the distance between the proposed opencast area and the watercourse is approximately 100 m. An indicative flood level of the watercourse was calculated for a cross section in this water course next to the opencast area to check whether the opencast area may fall within a potential flood line. The results show that the water level is not approaching the boundary of the opencast area during a 1:100 year flood event. It is important to note that the simulated flood level was modelled utilising desktop information (20m contours) and as such is not considered highly accurate. However in order to fulfil all requirements of GN704, a detailed assessment will be undertaken in the EIA phase to calculate flood lines for this section.

Table 13: Catchment flood flows

1: 50 Peak Flood (m^3/s)	**Rational Method**	**Alternative Rational Method**	**Standard Design Flood Method**
Catchment 1	146.5	116.2	159.1
Catchment 2	19.7	15.2	21.3
Catchment 3	114.4	93.6	121.3
1: 100 Peak Flood (m^3/s)	**Rational Method**	**Alternative Rational Method**	**Standard Design Flood Method**
Catchment 1	187.4	139.2	201.5
Catchment 2	25.5	18.4	27.0
Catchment 3	146.1	112.9	153.6

3.12.3.3 Site Sensitivities and Constraints

Site sensitivities may occur where the planned infrastructure for the preferred Alternative 3 site is located within a ‘very high’ sensitive area (also referred to as ‘no–go’ areas according to GN704 and represent the 100m buffer areas around water features). Most importantly, the proposed underground area will intersect with several water courses and is therefore partially located in the very highly-rated sensitive areas (no-go areas).

A site constraint identified for Alternative 3 is GN704 and Regulation 77 of the National Water Act (Act 36 of 1998) which places restrictions on the mining activities for the protection of water resources.

3.12.4 CONCLUSION

The Leiden project is located within the W52 and W53 quaternary catchments (Mfolozi/Pongola catchment). The catchments of the upper reaches of the Ngwempisi River (W53A), to the north and Hlelo River (W52A) to the south, are moderately disturbed. A large inter-basin water transfer scheme releases some 45 million cubic meters of raw water into the Ngwempisi River. This water flows down the slightly modified watercourse of the Ngwempisi River, through the northern section of the Mining Rights Area.

Both quaternary catchments fall within the W50 (Usuthu River Basin) drainage area, which constitutes an internationally shared basin and will be subject to existing treaties that govern releases and water quality at the Swaziland border. The water requirements of Swaziland are an important factor in this catchment, and it is accepted that 50% of natural base-flow for the rivers should be available at the downstream border of Swaziland, and that water should at least meet South African SANS standards for irrigation water. Base-line water quality analyses indicate that the surface water quality is reasonably good and should be used as a benchmark for the future water quality of the water affected by the Leiden operations.

The watercourses within the application area have been identified as highly sensitive areas. The results of the assessment show that the predicted water level of the watercourse is not approaching the boundary of the opencast area during a 1:100 year flood event. However in order to fulfil all requirements of GN704, a detailed assessment will be undertaken in the EIA phase to calculate flood lines for this section. However the proposed underground area will intersect with several water courses and is therefore partially located in a highly sensitive area.

3.13 WETLANDS

Wetland Consulting Services (WCS) was appointed by EIMS to undertake the wetlands specialist study for the Leiden project. The following sections provide a summary of the wetlands that may be affected by the proposed Leiden project. Information has been sourced from the WCS EIA report. For further information, please refer to the full wetlands EIA report which is included in Appendix K.

3.13.1 INTRODUCTION

The presence of wetlands in the landscape can be linked to the presence of both surface water and perched groundwater. The wetland types are differentiated by their hydro-geomorphic (HGM) characteristics; i.e. the position of the wetland in the landscape, as well as the way in which water moves into, through and out of the wetland systems. Mining activities have the potential to damage and/or disturb wetland habitat, deterioration of water quality, erosion, increased transport and sedimentation in wetlands, increased alien vegetation, increased surface run-off, and the deterioration of water quality. A EIA wetland study has been undertaken to identify wetlands within the site and to delineate these sensitive areas.

3.13.2 DATA COLLECTION

A desktop study was completed to establish a baseline understanding of the receiving environment together with the delineation of suspected wetland areas based on available aerial imagery, including colour 1:10 000 aerial photographs, black and white 1:10 000 aerial photographs and Google Earth imagery. A site visit was also undertaken to verify the findings of the desktop delineation. It should however be noted that ground truthing of wetland boundaries was targeted to a specific wetland system only (e.g. the wetland system adjacent to the proposed opencast mining area) and undertaken based on the wetland delineation guidelines published by the Department of Water Affairs (DWAF, 2005).

3.13.3 RESULTS

The wetlands located on the project area, Leiden 340 IT, have been delineated in Figure 17.

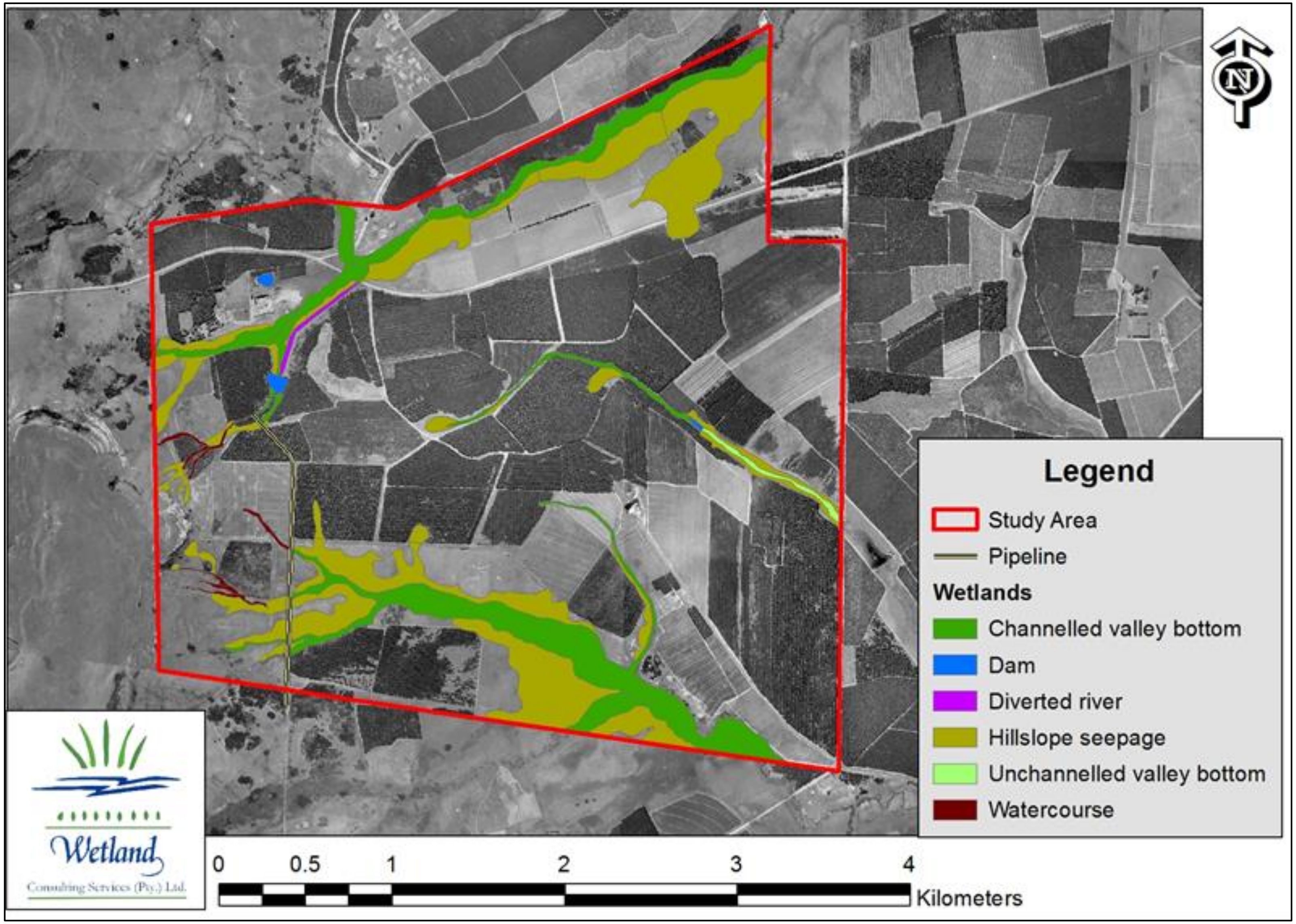


Figure 17: Map of the delineated wetlands on site

Three wetland systems were identified in the study area, all draining from west to east. In the north, the upper reaches of the Ngwempisi River fall within the study site; in the south an unnamed tributary of the Hlelo River originates on site; and within the central regions of the site a smaller, third wetland systems originates and eventually forms a tributary of the southern wetland system.

The northern Ngwempisi wetland systems is characterised by a channelled valley bottom wetland and associated hillslope seepage wetlands located mostly along the southern bank. The valley bottom wetland has been heavily impacted and invaded by alien tree species, mostly *Acacia mearnsii* (black wattle), while the southern hillslope seepage wetland has mostly been converted to planted pasture. A pipeline was observed discharging into the upper reaches of this wetland system, presumably a catchment transfer scheme from the nearby Heyshope Dam, and thought to form a sub-system to the Usutu-Vaal Government Water Scheme.

The central wetland system consists of a narrow valley bottom system that is channelled in its upper reaches but unchannelled downstream of the small farm dam. A narrow band of footslope seepage wetlands occur along the margins of the valley bottom. This wetland system drains an area of intensive plantation forestry with mostly pine plantations extending up to the edge of the wetland system and, for a portion of the upper reaches, right across the wetland. The plantations present would have played a role in reducing flows within the system.

The southern wetland system is located within the largest area of natural grassland remaining on site. The system originates on the steep slopes in the west of the study site as a number of narrow riparian zones and channelled valley bottom wetlands. Once the slope decreases the system widens significantly and becomes a broad, flat valley bottom wetland with a clearly incised channel. A narrow riparian fringe extends along the channel. Widespread hillslope seepage wetlands occur on both side of the valley bottom wetland.

In total, the wetlands cover 239.2 hectares (ha) of the site, equal to roughly 18.5% of the surface area. The dominant wetland types on site are the hillslope seepage wetlands (almost 60% of wetland area) and the channelled valley bottom wetlands (35% of wetland area). Four small farm dams were also observed on site. The total area of the wetland types are described in Table 14 below.

Table 14: Wetland types

Wetland Type	Area (ha)	% of Wetland Area	% of Study Area
Channelled valley bottom	85.25	35.64	6.60
Unchannelled valley bottom	2.49	1.04	0.19

Wetland Type	Area (ha)	% of Wetland Area	% of Study Area
Riparian zone	5.79	2.42	0.45
Hillslope seepage	142.28	59.49	11.02
Diverted river	1.60	0.67	0.12
Dam	1.76	0.73	0.14
Total	239.17	100.00	18.52

3.13.3.1 Site sensitivities and constraints

Potential site sensitivities identified are the affected Hlelo and Ngwempisi River catchments that will be affected by the development. Spatially, the proposed mine is located within the headwaters of two river systems and impacts will therefore be spread across two catchments, with the main impacts being to the Hlelo catchment.

One site constraint was identified, namely all wetlands are considered important ecosystems according the National Water Act. The Act also poses restrictions on developments within 500m of any wetland boundary through the requirement of Water Use License Applications for activities taking place within this “regulated area”.

3.13.4 CONCLUSION

Based on the desktop wetland delineation, wetland habitat covering more than18 % of the study area is expected to occur on site. Three wetland types – hillslope seepage wetlands, channelled valley bottom wetlands, and unchannelled valley bottom wetlands – occur on site, with hillslope seepage wetlands being the dominant wetland type. A discharge point of a catchment transfer scheme also occurs on site.

Although the wetlands have been exposed to frequent impacts associated with agricultural activities, the wetland types and wetland vegetation type occurring on site are indicated as being Critically Endangered, indicating that significant loss of these wetlands has occurred within the area, elevating the importance of the remaining wetlands.

The proposed mining activities, opencast and underground, as well as related infrastructure developments are likely to impact extensively on the wetlands of the area.

3.14 AQUATIC ECOLOGY

Wetland Consulting Services (WCS) was appointed by EIMS to undertake the aquatic ecology specialist study for the Leiden project. The following sections provide a summary of the aquatic environment that may be affected by the proposed Leiden project. Information has been sourced from the WCS EIA report. For further information, please refer to the full Aquatic Ecology Report which is included in Appendix L.

3.14.1 INTRODUCTION

The aquatic habitats form the template of the biological composition of any system. If the habitat components are undisturbed, and in good condition, the biological composition of the system can be expected to be normal and one can expect a high biodiversity within the system. If the habitat components are however degraded, due to human activities, the biota of the system will reflect this by a loss, firstly of the most intolerant species (Davies & Day, 1998). The proposed mining activities have the potential to result in a loss of aquatic ecosystems, a loss of biodiversity, alteration of the hydrological regime, the spread of alien fish species, a decline in water quality, and erosion and sedimentation of water courses.

3.14.2 DATA COLLECTION

A desktop study of the site was undertaken and the study area was visited in November 2013. Sites were selected to be representative of all the aquatic ecosystems within the study area and which could potentially be affected by proposed developments.

Fish sampling of representative sites and habitats was performed using a SAMUS battery operated electro-fisher by wading in shallow habitats and using a boat in deeper areas. All fish species were identified to species level and returned to their natural habitats. The latest version of the Fish Response Assessment Index (FRAI) (Kleynhans, 2008) was used to determine the Present Ecological Status (PES) of the aquatic ecosystem in the study area.

The description of the PES of the aquatic ecosystems in the study area was broadly conducted according to the methodology described for River EcoClassification during Reserve Determinations (Kleynhans & Louw, 2008). The overall PES of different river reaches was based on the results of the draft (preliminary) desktop update of PES and Ecological Sensitivity (ES) and Ecological Importance (EI) project (currently conducted by Department of Water Affairs). Kleynhans & Louw (2008) defined ecological importance of a river as its importance to maintain biological diversity and ecological functioning on a local and wider scale. The ecological sensitivity (or fragility) on the other hand refers to a river's ability to resist disturbance and its capability to recover from disturbances once it has occurred. The EI and ES of the river reaches of concern were determined using the desktop update of PES EI-ES (in progress).

Table 15: PES

CATEGORY	BIOTIC INTEGRITY	DESCRIPTION OF GENERALLY EXPECTED CONDITIONS
A	Excellent	Unmodified, or approximates natural conditions closely. The biotic assemblages compares to that expected under natural, unperturbed conditions.
B	Good	Largely natural with few modifications. A change in community characteristics may

CATEGORY	BIOTIC INTEGRITY	DESCRIPTION OF GENERALLY EXPECTED CONDITIONS
		have taken place but species richness and presence of intolerant species indicate little modifications. Most aspects of the biotic assemblage as expected under natural unperturbed conditions.
C	Fair	Moderately modified. A lower than expected species richness and presence of most intolerant species. Most of the characteristics of the biotic assemblages have been moderately modified from its naturally expected condition. Some impairment of health may be evident at the lower end of this class.
D	Poor	Largely modified. A clearly lower than expected species richness and absence or much lowered presence of intolerant and moderately intolerant species. Most characteristics of the biotic assemblages have been largely modified from its naturally expected condition. Impairment of health may become evident at the lower end of this class.
E	Very Poor	Seriously modified. A strikingly lower than expected species richness and general absence of intolerant and moderately tolerant species. Most of the characteristics of the biotic assemblages have been seriously modified from its naturally expected condition. Impairment of health may become very evident.
F	Critical	Critically modified. Extremely lowered species richness and an absence of intolerant and moderately tolerant species. Only intolerant species may be present with complete loss of species at the lower end of the class. Most of the characteristics of the biotic assemblages have been critically modified from its naturally expected conditions. Impairment of health generally very evident.

It must be emphasised that the A→F scale represents a continuum, and that the boundaries between categories are notional, artificially-defined points along the continuum. This situation falls within the concept of a fuzzy boundary, where a particular entity may potentially have membership of both classes (Robertson *et al.,* 2004). These boundary categories are denoted as B/C, C/D, etc.

The Index of Habitat Integrity (IHI) was used to determine habitat condition. This approach is based on the assessment of physical habitat disturbance (Kleynhans, 1997) and classifies the present ecological state of instream and riparian habitat integrity according to the Present Ecological State categories given in **Table 15**, ranging from pristine/undisturbed to critically modified. Analysis of major anions and cations, conductivity, TDS, pH and temperature was conducted. These data were interpreted in terms of ecological responses only. Aquatic macroinvertebrates were assessed using the SASS 5 (South African Scoring System) methodology. SASS5 is based on the presence or absence of sensitive aquatic macroinvertebrates collected and analysed according to the methods outlined in Dickens and Graham (2002).

On-site habitat assessments were conducted by using existing habitat evaluation indices. The general characteristics of the site and its immediate surroundings were described. The composition and ability of the habitats to meet the requirements of different fish species were broadly based on the Habitat Cover Rating method (Kleynhans, 1997). This approach was developed to assess habitats according to different attributes that are surmised to satisfy the habitat requirements of various fish species (Kleynhans, 1997). A simplified index of habitat integrity, namely Site Habitat Integrity (SHI) was used to determine the broad habitat integrity or condition, based on the extent that different human activities may have on the fish habitats at each sampling site. This approach is based on the assessment of physical habitat disturbance (Kleynhans, 1997).

3.14.3 RESULTS

The Leiden study site is located south of the N2 between Ermelo and Piet Retief and stretches across two catchments: W52A and W53A. Catchment W52A is drained by the Hlelo River and its tributaries, while W53A is drained by the Ngwempisi and its tributary, the Sandspruit. The Hlelo River is itself a tributary to the Ngwempisi, which in turn is a tributary to the uSuthu. The uSuthu is an international river, draining across Swaziland and into the Phongola River, which flows along the border between South Africa and Mozambique to the Indian Ocean. The Department of Water Affairs and Forestry (DWAF) desktop survey (Kleynhans, 2000) classifies both quaternary catchments as having both a High Ecological Importance and a High Ecological Sensitivity.

Based on the preliminary results of the DWA study, the Ngwempisi River reach in the study area, as well as the downstream receiving reach, is considered to be Largely Modified (Category D). The tributary of the Hlelo River within and adjacent to the study area is classified as Largely Natural (Category B) while the downstream receiving Hlelo River reach is considered Moderately Modified (Category C).

Most of the reaches of concern are of moderate ecological importance according to the DWA study. The exceptions are the Hlelo tributaries (W52A-1934) which are classified as being of high ecological importance. All reaches of concern are classified as being of high ecological sensitivity.

The on site assessment of habitat integrity, using the Index of Habitat Integrity confirmed the desktop findings to some extent. The overall Present Ecological State (PES) was considered Pristine (Category A) to Largely Natural (Category B) within the Hlelo tributaries. Within the Ngwempisi River, habitat integrity was relatively good (Category B, Largely Natural) upstream of the site but deteriorated sharply downstream of the interbasin transfer (from Heyshope Dam) discharge point. The downstream site was considered moderately to Largely Modified (Category C to D) in terms of habitats. The high volumes and velocities of transferred water within the Ngwempisi have significantly altered flows, eroded out marginal habitats, scoured the river bed and inundated instream habitats. Water quality was considered good at all sites and no physico-chemical measurements were found to be limiting to aquatic biota.

The aquatic macroinvertebrate results confirmed the above findings. Most current impacts to aquatic ecosystems are to habitats and not to water quality. More than two species of baetid mayfly were recorded at all sampling sites, indicating good water quality. Taxa sensitive to changes in water quality and habitats were prevalent at all Hlelo tributary sites and the upstream Ngwempisi site.

The Hlelo tributaries were considered Pristine to Moderately Modified (Category A-B) for aquatic macroinvertebrates. Within the Ngwempisi River, there was a significant decrease in diversity evident between the upstream and downstream Ngwempisi sites as a result of the loss of habitats due to increased flows from the inter-basin transfer. The Ngwempisi River was classified as Moderately Modified (Category C) at its downstream site. However, sensitive taxa were still present indicating that that the decline in PES was mainly due to habitat loss and not water quality deterioration.

The diversity of Odonata (dragonflies and damselflies) was particularly high within the study area and included rarer damselfly families (Chorolestidae and Lestidae – the latter family collected from Site N1 (See Figure 18) and all Hlelo tributary sites). A less common dytiscid beetle (as yet unidentified) was also observed. This diversity within the Coleoptera and Odonata points to a high overall invertebrate diversity within the region.

The most significant impact on the site-specific habitat integrity for fish of the streams in the study area was identified to be flow modification, bed modification, channel modification, inundation, exotic vegetation encroachment and bank erosion. The primary causes of these impacts were related to the inter basin transfer as well as forestry in the area.

The diversity of velocity-depth categories was generally low with only slow-shallow and slow-deep habitats being present. Cover features for fish were generally limited, mostly being provided in the form of overhanging vegetation, undercut banks and substrate (stones).

During the baseline survey conducted at selected sites in the study area during November 2013 two indigenous fish species (*Barbus pallidus* and *Barbus anoplus*) and one alien fish species *Micropterus salmoides* were sampled. Fourteen fish species have a low to definite probability of occurrence in the river reaches of concern (study area and downstream receiving reach).

Barbus brevipinnus is listed as vulnerable based on the latest IUCN classification (moderate to high probability of occurrence in the area). *Chiloglanis emarginatus* was previously classified as near threatened (Skelton, 2004) but according the latest IUCN ratings it is now least concern. This species is however very scarce and should its presence be confirmed inside or downstream of the study area, it should be treated as a species of conservation importance. The remainder of the expected or observed fish species are not classified as threatened on any scale (international, national or regional) but the distribution ranges of many of these species are however decreasing due to increased development and deterioration in the condition of their habitat.

Based to the FRAI index results (indicating the present ecological status based on fish assemblage), the Ngwempisi River is currently in a Largely Modified state (category D), while the tributary of the Hlelo River is in a relatively good state (B, Largely Natural). Fish assemblages are responding to the following identified stressors: inter basin transfer and forestry resulting in flow modification, sedimentation, physical disturbance, water quality deterioration, migration barriers and the presence of a predatory alien fish species.

In terms of the overall aquatic diversity assessment, the southern catchment (W52A), which covers roughly two thirds of the study area, is considered “Highly Significant”; while the northern sub-catchment (W53A) is termed to be important for “Ecosystem Maintenance”.

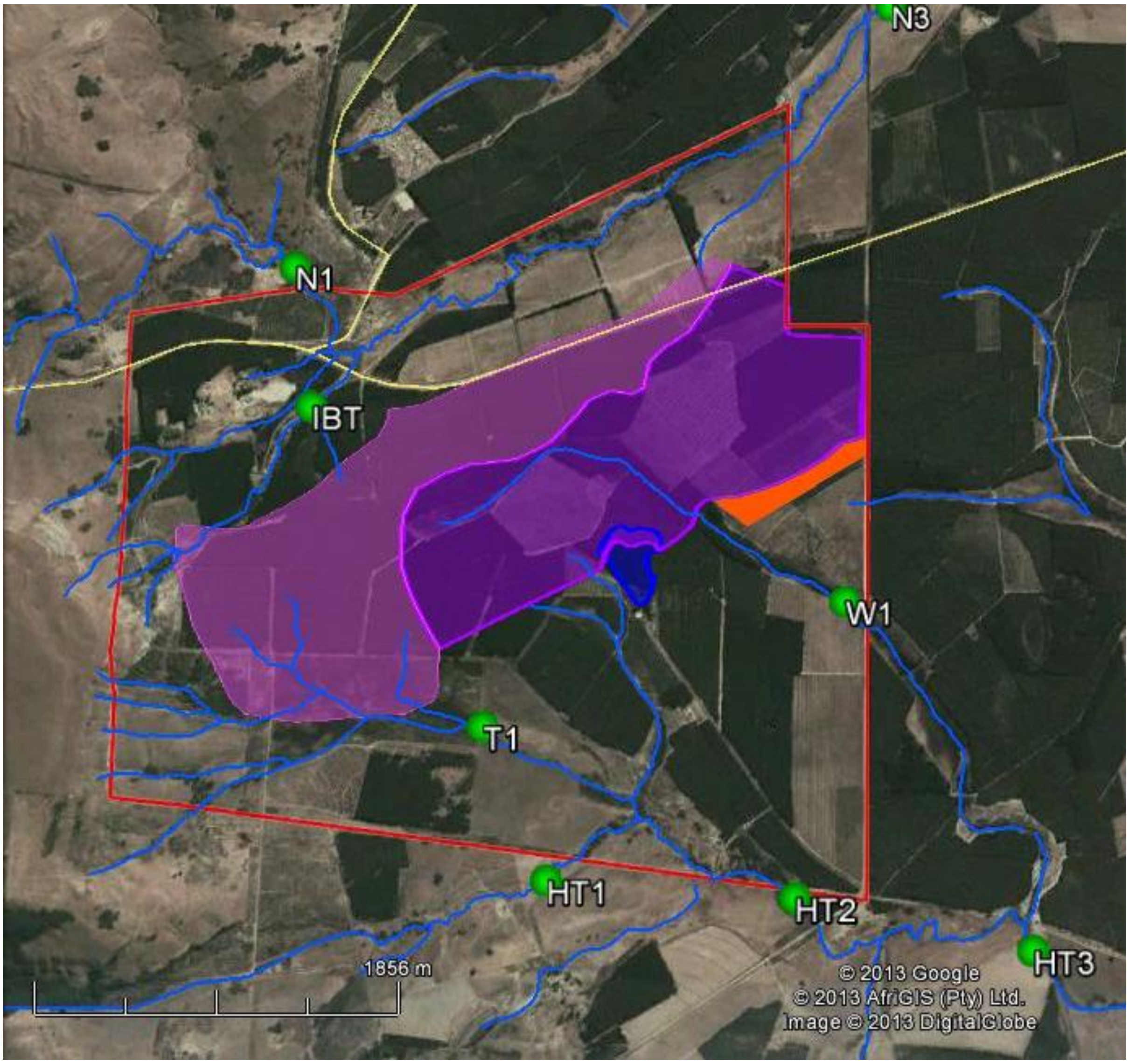


Figure 18: Google Earth image showing aquatic sampling sites for the Leiden project. Purple represents proposed underground mining, orange represents proposed open-cast mining and blue represents existing underground mining

3.14.3.1 Site Sensitivities and Constraints

All wetlands are considered important ecosystems according to the National Water Act. Furthermore the act poses restrictions on development within 500 m of any wetland boundary through the requirement of Water Use License Applications for activities taking place within this "regulated area". The sensitivity of a site however depends on the extent, duration and magnitude of the disturbance as well as the resilience of an effected ecosystem to recover. Due to the proposed location of the mine in the headwaters of the Hlelo and Ngwempsi River the impacts may potentially spread across both catchments. The water quality and biotic integrity of the ecosystems is likely to be affected, therefore degrading the ecosystem from Pristine to Largely Natural.

3.14.4 CONCLUSION

There are two river systems that will be affected by the proposed development. Both flow in an easterly direction and converge in Swaziland to form the Usutu River which then flows through Mozambique to the Indian Ocean. The study area falls over two quaternary catchments, namely W53A and W52A. The DWAF desktop survey (Kleynhans 2000) classifies both quaternary catchments as having an Ecological Importance and Sensitivity of 'High'.

The risk of water quality deterioration is highlighted given the current good quality water within the affected river systems, the Ngwempisi and Hlelo Rivers, which also support a number of sensitive aquatic species and have been classed as Freshwater Ecosystem Priority Areas (FEPA's). The presence of the catchment transfer scheme further highlights the need to focus on maintaining water quality as any impairment could have significant impacts on downstream water users.

3.15 GROUND WATER

GCS Water and Environmental Consultants was appointed by EIMS to undertake the ground water specialist study for the Leiden project. The following sections provide a summary of the ground water resources that may be affected by the proposed Leiden project. Information has been sourced from the GCS EIA report. For further information, please refer to the full ground water EIA report which is included in Appendix M.

3.15.1 INTRODUCTION

Ground water is defined as water located beneath the ground surface in lithological formations. Mining activities have the potential to impact on ground water resources through potential pollution and/or contamination as a result of activities such as the actual mining method employed and resultant geological exposure of oxidising materials, seepage, spillages and both mineralised and non-mineralised waste streams. Additional impacts related to mining activities also include dewatering cones of depression and loss of water supply to surrounding land users.

3.15.2 DATA COLLECTION

A desktop study was completed whereby public domain information together with information supplied by the client was used to develop a central database. The following information was used:

- 1:250 000 scale geological map data for the site area;
- National Groundwater Archive (NGA) data that was available for the site area and its surroundings;

- Previous consultant reports completed for the historic Leiden Section underground mining operations, Kangra Coal Ltd (e.g. GCS, 1998);
- Water Research Commission hydrogeological reports related to coal mining, applicable to the site area and setting (e.g. Hodgson and Krantz, 1998, Hodgson *et al.*, 2007); and
- Public domain climatic and topographic data for the site.

A site visit was undertaken in October 2013 to develop a hydrocensus and to identify other important site features onsite. The hydrocensus was completed in a 2 km radius from the site, during which nine (9) boreholes, three (3) springs and three (3) surface water points were identified and investigated. The following information was recorded at each of the sites identified:

- GPS Coordinates (decimal degrees, WGS84);
- General site conditions;
- Water usage;
- Ownership of the feature (where applicable);
- Field parameters (e.g. pH and electric conductivity (EC));
- Water level or flow regime; and
- Equipment installed (where applicable).

A total of eight (8) water samples were taken at the site. Six boreholes were sampled using a plastic, single valve bailer and two samples were taken from groundwater discharge areas or seeps. The location of the sampling points is shown in Figure 19. The sample analyses results were compared to the SANS 241 (2011) standard for drinking water and the DWA South African Water Quality Guideline (SAWQG) target values for domestic use.

3.15.3 RESULTS

The application area is located within the W52A and W53A quaternary catchment. The geology is important to understand as the aquifer of permeable rock can either contain, or transmit groundwater. The data collection indicated that the surrounding area is underlain mainly by shale and sandstone formations from the Vryheid Formation from the Karoo Supergroup. Due to the presence of dolerite dykes and sills in portions of the application area, faults do occur, with the main fault located to the east of the application area.

3.15.3.1 Aquifer Description

The Karoo super group is known to display two main aquifers, namely:

- A shallow weathered zone aquifer, where water is stored and transmitted within the upper soils and highly weathered lithologies within the upper 20 m below ground level (bgl). The shallow weathered aquifer is typically low yielding and is generally not used for water supply, with blow yields varying between 0.5 and 2 l/s; and

- A deeper fractured rock aquifer, where water is stored and transmitted within fractured lithology units and at the contact between weathered and competent lithologies. The fractured rock aquifer is typically found between 20 and 50 m bgl, but may occur at deeper levels depending on the structural geology of the area. The deeper fractured rock aquifer shows typical blow yields ranging between 0.5 and 3 l/s on average, with exceptions between 5 and 10 l/s found at dolerite intrusion contacts and fault zones.

3.15.3.2 Hydrocensus Results

The hydrocensus was completed in a 2 km radius from the site, during which nine (9) boreholes, three (3) springs and three (3) surface water points were identified and investigated. Of the eight boreholes, four were used for domestic supply and livestock watering, two were monitoring points for the abandoned Leiden Colliery boxcut (owned by Kangra) and two were not in use. The borehole, seeps and spring locations can be seen in Figure 19. Water levels varied between 3 and 20 m bgl, which suggests the presence of the two types of aquifer as described above, i.e. shallow weathered zone and deeper fractured. The water levels showed a 95% correlation with topography, indicating that groundwater mimics topography and takes place under unconfined to semi-confined conditions.

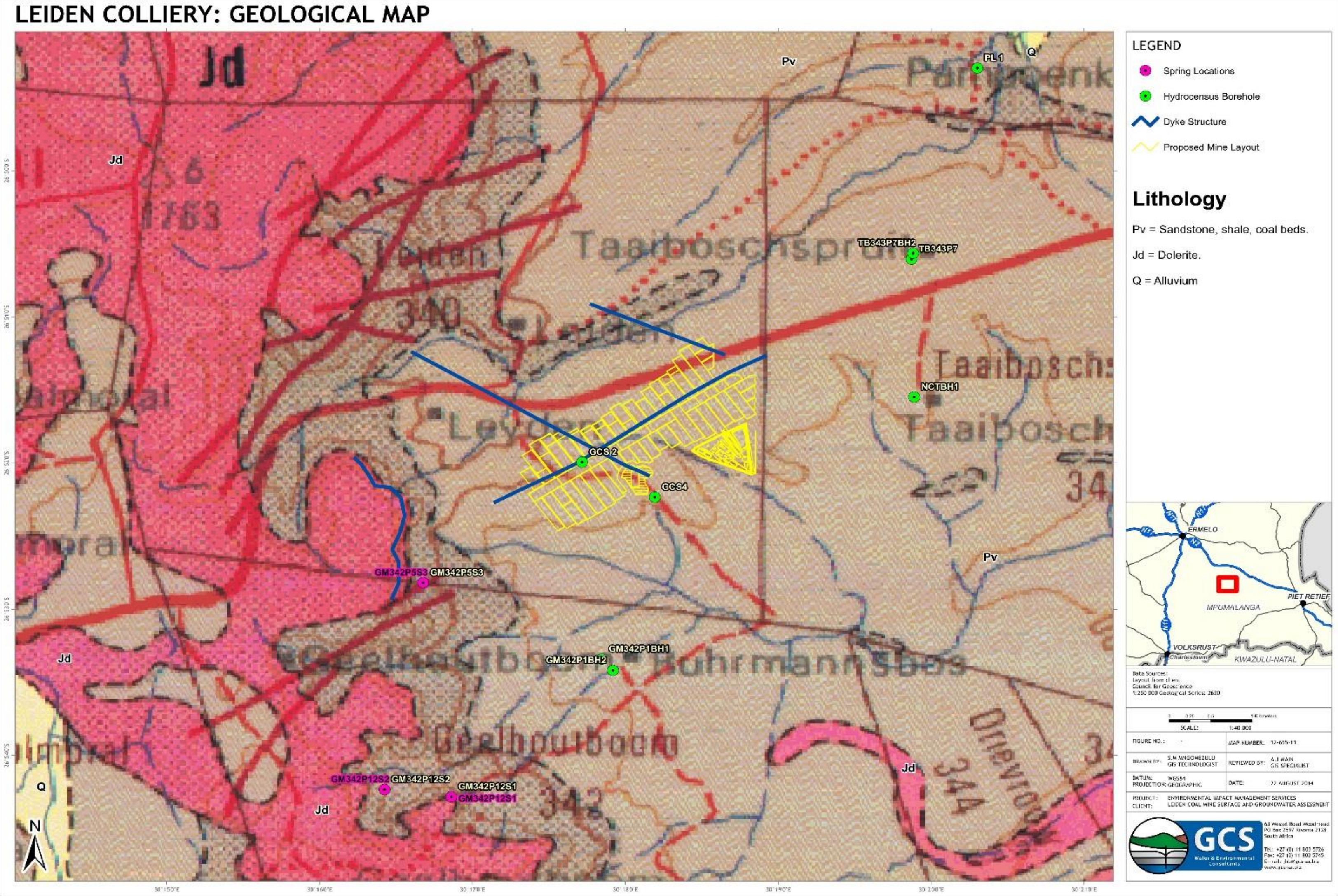


Figure 19: Groundwater sample locations

3.15.3.3 Groundwater Quality

A total of eight (8) samples were taken at the site, six from boreholes and two samples from groundwater discharge areas or seeps (Figure 19). The following results were found:

- The boreholes GCS 2, GM341P1BH1, PL1 and TBP7BH1 complied with both the SANS limits and the DWA SAWQG target values,
- The borehole GCS 4 exceeded the DWA SAWQG target values for manganese as well as the groundwater seepage point WN2, and
- The groundwater seepage sample site WN1 exceeded the DWA SAWQG target values for aluminium and iron and exceeded the SANS 241 (2011) limit for pH and manganese. The exceedance of the SANS (2011) limit is indicative of potential contamination of the ground water seepage due to previous coal mining. The site visit (to a certain degree) confirmed this as a road constructed nearby the sampling point was constructed using potentially coal bearing rock.
- The borehole NCTBH1 exceeded the DWA SAWQG target values for electrical conductivity (EC), fluoride, calcium and magnesium, while exceeding the SANS 241 (2011) limit for sulphate (SO_4).

On the evidence of the above results it is apparent that groundwater quality is generally good across much of the site, however there is evidence of localised groundwater contamination which is possibly linked to historical mining activities.

3.15.3.4 Site Sensitivities and Constraints

The proposed mining activity is unlikely to impact on any groundwater users. However the mining activities are likely to impact on the surface water environment given the close proximity of the unnamed stream.

3.15.4 CONCLUSION

Mining activities have the potential to impact on ground water through a number of potential pollution sources. Groundwater monitoring is of great importance as mining activities extend into the ground and can potentially affect groundwater. Thus, a baseline of the environment is required and has been established in the groundwater assessment as well as sensitive area mapping/ranking within the application area.

The area displays two main aquifers, namely a shallow weathered aquifer and a deeper fractured aquifer. The shallow weathered aquifer is typically low yielding and is generally not used for water supply. The deeper fractured rock aquifer, is typically found between 20 and 50 m bgl, and shows typical blow yields ranging between 0.5 and 3 l/s on average, with exceptions between 5 and 10 l/s found at dolerite intrusion contacts and fault zones.

The hydrocensus indicated nine boreholes, three springs and three groundwater seepage features. It was found that the majority of these boreholes are used for domestic water supply and livestock watering with the two other boreholes being used as monitoring points and two that had been abandoned. The water levels found were between 3 – 20 m below ground level (bgl), these depths are indicative of the afore mentioned aquifers.

Water quality results indicated that groundwater quality is generally good across much of the site, however there is evidence of localised groundwater contamination which is possibly linked to historical mining activities. The site visit (to a certain degree) confirmed this as a road constructed nearby the sampling point was constructed using potentially coal bearing rock

3.16 AIR QUALITY

Airshed Planning Professionals (Pty) Ltd was appointed by to undertake the air quality specialist study for the Leiden project. The following sections provide a summary of the air quality that may be affected by the proposed Leiden project. Information has been sourced from the Airshed EIA report. For further information, please refer to the full air quality EIA report which is included in Appendix N.

3.16.1 INTRODUCTION

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change the in ambient air quality can result in a variety of impacts which in turn may cause a disturbance to and/or health impacts on nearby receptors. Sensitive receptor sites include residential areas, communities, and natural environments. Mining activities have the potential to result in increased levels of atmospheric dust, increased concentrations of PM_{10} (Particulate Matter with an aerodynamic diameter of less than 10μm) and increased concentrations of $PM_{2.5}$ (Particulate Matter with an aerodynamic diameter of less than 2.5μm). Historical evidence indicates that the pollutant of concern associated with open-cast mining operations is particulate matter creating a nuisance dust source and resulting in human health concerns and nuisance.

3.16.2 DATA COLLECTION

Air quality data was collected in a number of ways. A baseline air quality characterisation was attained by collection and analysis of historical records (e.g. Weather Bureau Reports). Local meteorological conditions were described using MM5 modelled meteorological data for the application area (26.866761°S; 30.308845°E) during the period January 2010 – December 2012. The data included hourly average wind speed, wind direction and temperature. Additional literature regarding the effects of air quality on the environment and human health were also utilised. A site survey was also conducted in September 2013 during which the potential sources of emissions as a result of the mining operations were investigated.

3.16.3 RESULTS

A number of potential sources of emissions have been identified in the region within which the application falls and these contribute the ambient air quality. These land-uses contribute baseline emission sources via vehicle tailpipe emissions, household fuel combustion, biomass burning, and various fugitive dust sources. These sources of emissions are:

- Power Stations.

  Operational power stations that fall within the Mpumalanga Highveld region. These electricity generation operations emissions are carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen dioxides and ash (particulates). Fly-ash particles emitted contain various trace elements such as arsenic, chromium, cadmium, lead, manganese, nickel, vanadium, and zinc. Small quantities of volatile organic compounds are also released from such operations.

- Mines.

  There are a number of coal mines located to the northwest of the application area, in close proximity to Ermelo. These activities mainly result in fugitive dust releases with small amounts of nitrogen oxides (NO_x), carbon monoxide (CO), SO_2, methane, and CO_2 being released during blasting operations.

- Fugitive Emissions.

  Emissions from unpaved roads are expected to constitute a major source of emissions to the atmosphere in the region.

- Domestic Household Emissions.

  It is likely that households within the local communities or settlements will generate emissions through the combustion of coal, paraffin and/or wood for cooking and/or space heating purposes. These emissions would include respirable particulates, CO, SO_2, polycyclic aromatic hydrocarbons (PAHs), heavy metals, NO_2 and various toxins.

- Biomass Burning.

  Within the project vicinity, crop-residue burning and veld fires may represent significant sources of combustion-related emissions. Biomass burning is an incomplete combustion process (Cachier, 1992), with carbon monoxide, methane and nitrogen dioxide gases being emitted.

- Fuel combustion emissions.

  Emissions resulting from motor vehicles can be grouped into primary and secondary pollutants. While primary pollutants are emitted directly into the atmosphere, secondary pollutants form in the atmosphere as a result of chemical reactions.

Significant primary pollutants emitted by internal combustion engines include CO_2, CO, carbon (C), SO_2, oxides of nitrogen (mainly NO), particulates and lead.

- Refuse and tyre burning.

  An additional source of emissions is the waste sector especially from informal refuse and tyre burning. The informal burning of refuse tips (dumps) within former township areas and burning of waste at local municipal landfill sites represents a source of concern in all provinces.

The baseline air quality for the region is unknown, with no ambient measurements available for any of the relevant particulates. It is assumed that the air quality within the application area is relatively good as there are no major sources of pollution located near the site. Fugitive dust sources identified to potentially occur in the study area include paved and unpaved roads; agricultural tilling operations; and wind erosion of sparsely vegetated surfaces. The main sources likely to contribute to cumulative PM_{10} impact are vehicle entrainment on unpaved road surfaces, windblown dust from exposed areas and biomass burning.

3.16.3.1 Sensitive Receptors

The closest residential development to the project area is Sheepmoor ~16 km to the north and Iswepe ~22km to the east-northeast. Individual residences (i.e. farm houses) as well as a local school are also within the study area of the proposed operations. The National Ambient Air Quality Standards (NAAQS) and Dust Deposition Guidelines are based on human exposure to specific criteria pollutants and as such, possible sensitive receptors were identified where the public is likely to be exposed. The NAAQS are enforceable outside of mine boundaries and therefore the sensitive receptors identified (Figure 20 include the nearest residential areas in the region that occur within a 7.5 km boundary line in all directions (i.e. a modelling domain of 15 km east-west and 15km north-south). Individual residences (i.e. farm houses and local schools) fall within the area of proposed operations.

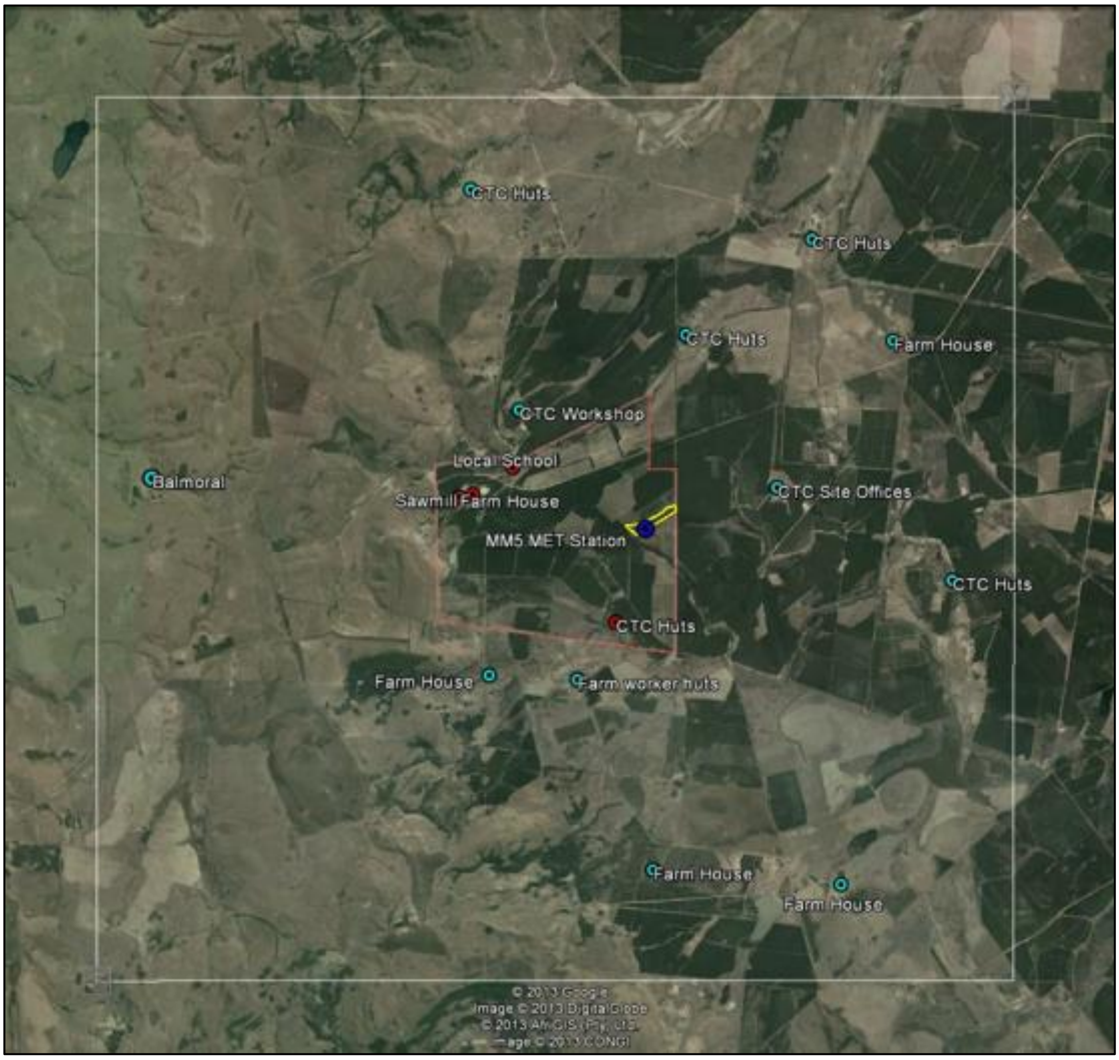


Figure 20: Potential sensitive receptors

The fugitive dust emissions may occur as a result of vehicle entrained dust from local paved and unpaved roads and wind erosion from open areas. The extent of particulate emissions from the main roads will depend on the number of vehicles using the roads and on the silt loading on the roadways.

3.16.3.2 Site Sensitivities and Constraints

The surrounding area is dominated by rural agricultural land in the form of forestry and livestock farming. The existing air quality is considered good as there are no large industrial sources of air pollution in a 20 km radius of the proposed Leiden coal mine. The nearest large source of air pollutant emissions is the Camden power station, located approximately 36 km northwest of the proposed operation. However, with the introduction of the Leiden Coal Mine, the air quality is likely to decrease. There are no site constraints identified at the proposed Leiden Coal Mine.

3.16.4 CONCLUSION

The baseline air quality for the region is unknown, with no ambient measurements available for any of the relevant particulates. It is assumed that the air quality is relatively good as there are no numerous major sources of pollution located near the site. The main sources likely to contribute to cumulative PM_{10} impact are vehicle entrainment on unpaved road surfaces, windblown dust from exposed areas, and biomass burning. The closest residential development to the project area is Sheepmoor ~16 km to the north and Iswepe ~22km to the east-northeast. Individual residences (i.e. farm houses) as well as a local school are also within the study area of the proposed operations. The school is considered a particularly sensitive receptor and the proximity to one of the proposed haul routes renders that option a no-go unless that section of road or the school are moved.

Mining operations are likely to increase ground-level $PM_{2.5}$ and PM_{10} concentrations and dust fall-out, thus increasing possible affects to human health. Since many of the impacts of particulates are dosage dependent, the extent of impact will be assessed during the EIA phase. The modelled ground-level concentrations of total suspended particulates (TSP), PM_{10} and $PM_{2.5}$ are compared to National Standards and Guidelines at the sensitive receptors in the EIA phase (see Appendix N).

3.17 VISUAL

Newtown Landscape Architects (NLA) was appointed by EIMS to undertake the visual specialist study for the Leiden project. The following sections provide a summary of the visual resource that may be affected by the proposed Leiden project. Information has been sourced from the NLA EIA report. For further information, please refer to the full noise EIA report which is included in Appendix O.

3.17.1 INTRODUCTION

The main aim of the visual impact specialist study is to ensure that the visual / aesthetic consequences of the proposed project are understood and adequately considered in the environmental planning process. Visual impacts would result from the construction, operation and decommissioning phase of the proposed Leiden Coal Mine. Specifically, visual impacts would result from the overburden dumps and the mining activities being seen from sensitive viewpoints (i.e. impacts of views from residences) and the negative effects (relating primarily to visibility and intrusion) on the scenic quality and sense of place of the landscape of the proposed site.

The landscape, its analysis and the assessment of impacts on the landscape all contribute to the baseline for visual impact assessment studies. The assessment of the potential impact on the landscape is carried out as an impact on an environmental resource, i.e. the physical landscape. Visual impacts, on the other hand, are assessed as one of the interrelated effects on people (i.e. the viewers and the impact of an introduced object into a particular view or scene). A qualitative evaluation of the landscape is essentially a subjective matter. In this study the aesthetic evaluation of the study area is determined by the professional opinion of the author based on site observations and the results of contemporary research in perceptual psychology. Landscape character, landscape quality (Warnock & Brown, 1998) and “sense of place” (Lynch, 1992) are used to evaluate the visual resource i.e. the receiving environment.

These measures are intrinsic to the landscape and thus they enable a value to be placed on the landscape that is independent of the person doing the viewing.

In determining the quality of the visual resource, both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide, the visual resource or perceived value of the landscape is considered to be very high.

3.17.2 DATA COLLECTION

In this study the aesthetic evaluation of the study area is determined by the professional opinion of the author based on site observations and the results of contemporary research in perceptual psychology.

A field survey was undertaken in September 2013 during which the study area was scrutinized to the extent that the receiving environment can be documented and adequately described. The landscape character was determined and mapped using the findings of the field survey and aerial photographic interpretation. The description of the landscape focused on the nature of the land rather than the response of a viewer.

The quality of the landscape was calculated and mapped as a measurement of the union of ecological integrity (overall health of the landscape) and aesthetic appeal. Aesthetic appeal has been described using contemporary research in perceptual psychology and the opinion of the specialist as the basis for determining its value.

The sense of place of the study area has been evaluated and mapped as the uniqueness and distinctiveness of the landscape. The primary informant of these qualities is the spatial form, character and the natural landscape together with the cultural transformations and traditions associated with historic and current use of the land.

Landscape character, landscape quality (Warnock & Brown, 1998) and “sense of place” (Lynch, 1992) are used to evaluate the visual resource i.e. the receiving environment. These measures are intrinsic to the landscape and thus they enable a value to be placed on the landscape that is independent of the person doing the viewing.

In terms of visual sensitivity mapping of the project site, a sensitivity map was produced by merging the results of a viewshed analysis and visual exposure analysis from sensitive viewer locations. The viewshed analysis indicated how many sensitive viewers could see a specific point on site, i.e. indicating the viewer incidence. The higher the viewer incidence, the higher the sensitivity of the area on the site. The visual exposure analysis indicated the relationship between the distance of the sensitive viewer location in relation to the project site. This was determined using a buffer zone / zone of potential influence of 5km which would include the fore- and middle ground distance of a sensitive viewer location. Nearer to the sensitive viewer location would be in the foreground of the viewer, thus having a higher impact on the viewer location.

3.17.3 RESULTS

3.17.3.1 Landscape Character

The study area has a placid and peaceful pastoral sense of place with the farmsteads and residences, schools and church introducing a rural component to the sense of place. The placid and peaceful sense of place is derived from the mountain back drop and undulating topography covered in plantations, crops and grassland vegetation. Grazing and other agricultural activities introduce the pastoral element.

Colours within the study areas are mostly dark greens from the plantations, light yellow-greens from the grassland vegetation as well as light browns and whites from the soils and geological formations. Greyish colours are introduced when plantations are harvested. Lines are flowing and mostly in the horizontal plane with no sharp angles and harsh lines in the vertical plane. Currently man-made structures include residence and farming outbuildings. The saw mill is located on the project site and quite well hidden from roads and farmsteads. Other structural man-made elements include the power lines criss-crossing the study area.

It is evident from the description of the landscape character above, that the introduction of the mining structures and related activities would create strong contrast with the existing landscape characteristics. It is further anticipated that indirect negative effects related to the mining activities such as dust and light pollution would also add to the major disruption of the landscape character and sense of place if left unmitigated.

3.17.3.2 Visual Receptors

Due to the nature of the mining operations and related activities the related infrastructure may stand out from the natural setting of the study area. This could possibly occur as a result of the clearance of some of the surrounding plantation which at present acts as a screen to the study area. However the screen is temporary due to harvesting cycles of the plantations.

The sensitivity of visual receptors and views are dependent on the location and context of the viewpoint, the expectations and occupation or activity of the receptor or the importance of the view. Travellers travelling along the dirt roads within and through the study area, would catch glimpses of the proposed mine structures and activities when driving along the roads. These views are however temporary of nature and regarded as having a moderate sensitivity. People engaged in work activities within the study area are regarded as having a low sensitivity due to the fact that their attention would be focussed on their work activity. Permanent views would be those from the farmsteads and residences within the immediate area and would be classified as having a high sensitivity.

The viewshed analysis, Figure 21 below, indicated how many sensitive viewers could see a specific point on site, i.e. indicating the viewer incidence. The higher the viewer incidence, the higher the sensitivity of the area on the site.

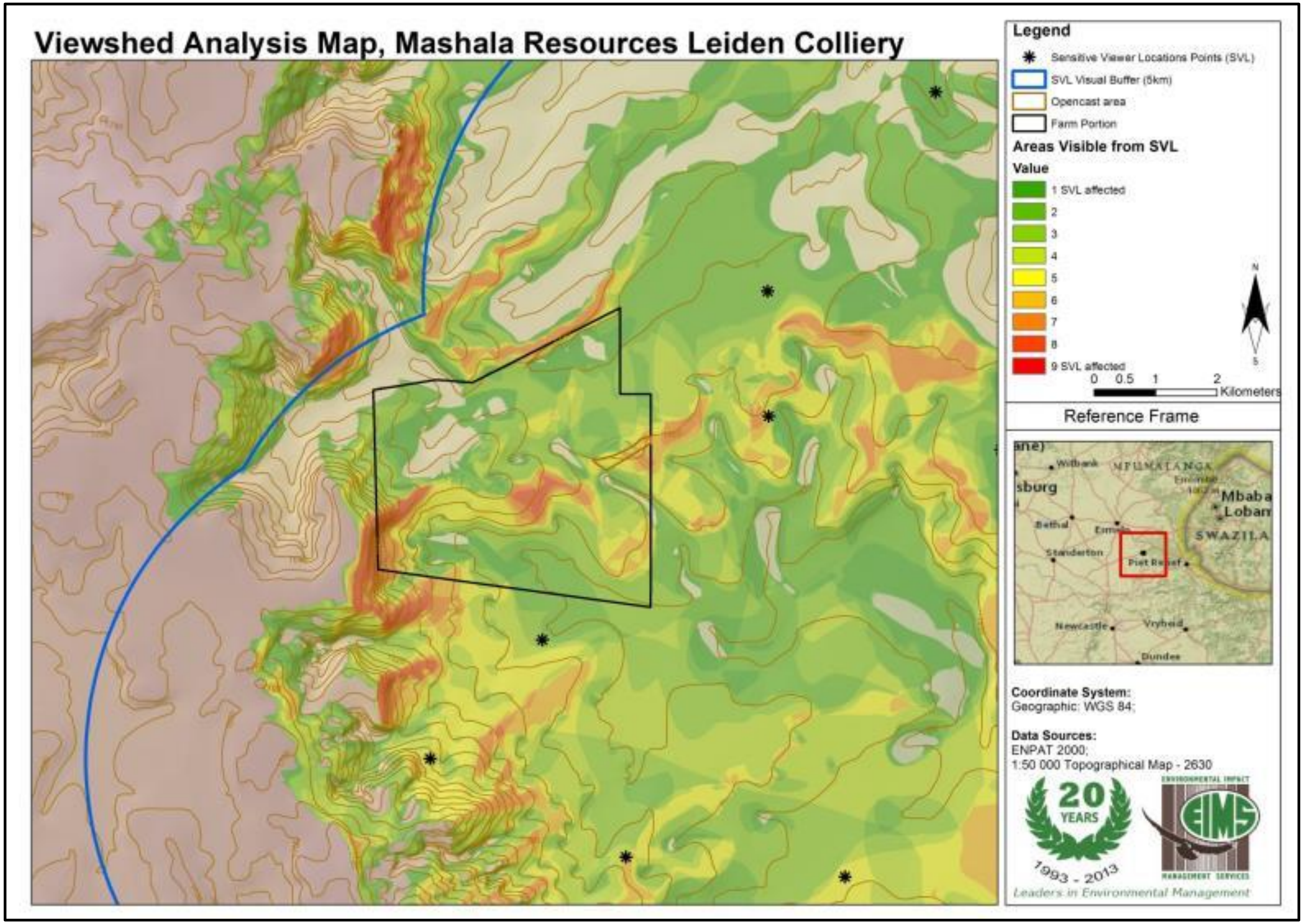


Figure 21: Viewshed analysis

The visual exposure map presented in Figure 22 indicated the relationship between the distance of the sensitive viewer location in relation to the project site. This was determined using a buffer zone / zone of potential influence of 5km which would include the fore- and middle ground distance of a sensitive viewer location. Nearer to the sensitive viewer location would be in the foreground of the viewer, thus having a higher impact on the viewer location. The results from the visual study indicated that the most sensitive viewer of the proposed operations would be the farmstead which is located to the south of the operations.

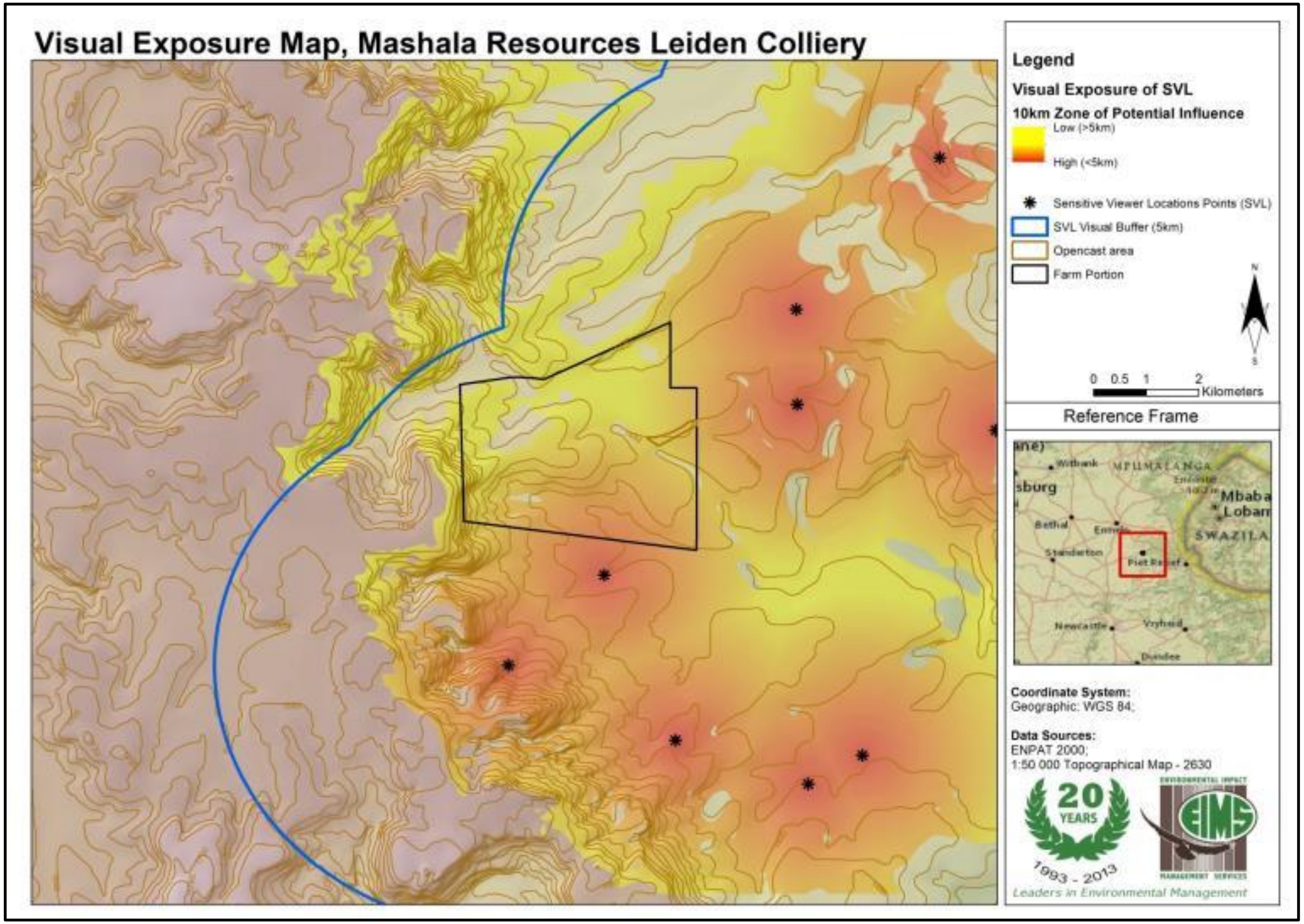


Figure 22: Visual exposure

3.17.3.3 Site sensitivities and constraints

The higher the viewer incidence, the higher the sensitivity of the area on the site. The south-eastern half of the site would be more sensitive than the north-western half. The north-western corner is the least sensitive area of the site. It was therefore recommended that the proposed infrastructure be located in this area of the site. This would have resulted in the proposed infrastructure being the furthest away from the sensitive viewer locations and having possibly the least sensitive viewer incidences.

There are no visual site ‘constraints’ to the site. There are however incidences where the proposed project would occur within the *high visual exposure zone* of two of the 9 SLV’s.

3.17.4 CONCLUSION

The study area has a placid and peaceful pastoral sense of place with the farmsteads and residences, schools and church introducing a rural component to the sense of place. The placid and peaceful sense of place is derived from the mountain back drop and undulating topography covered in plantations, crops and grassland vegetation. Grazing and other agricultural activities introduce the pastoral element. It is evident from the description of the landscape character above, that the introduction of the mining structures and related activities would create strong contrast with the existing landscape characteristics. It is further anticipated that indirect negative effects related to the mining activities such as dust and light pollution would also add to the major disruption of the landscape character and sense of place if left unmitigated.

The visual assessment has identified highly sensitive, moderately sensitive and low sensitive viewers that may potentially be affected by this project. The south-eastern half of the site has been determined to be more sensitive than the northwestern half, with the north-western corner being the least sensitive area of the site.

3.18 NOISE

Enviro Acoustic Research was appointed by EIMS to undertake the noise specialist study for the Leiden project. The following sections provide a summary of the noise environment that may be affected by the proposed Leiden project. Information has been sourced from the noise EIA report. For further information, please refer to the full noise EIA report which is included in Appendix P.

3.18.1 INTRODUCTION

Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk due to hearing damage.

It is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise. Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases, annoyance is seen as an outcome of disturbances, in other cases it is seen as an indication of the degree of helplessness with respect to the noise source. Noise does not need to be loud to be considered “disturbing”. One can refer to a dripping tap in the quiet of the night, or the irritating “thump-thump” of the music from a neighbouring house at night when one would like to sleep. Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

Certain noise generating activities associated with mining operations can cause an increase in ambient noise levels in and around the site. Significant noise is associated the most with opencast and plant (including workshops) activities. The only noisy activities relating to the underground mining activities are associated with the plant activities. A source of noise during the operational phase will be traffic to and from the site, traffic around the facility, ROM and product transport and activities associated with waste management.

Potential receptor sites include the residential areas and communities that occur on site and in the surrounding environment. Considering the potential for nuisance due to noise, it is essential that a noise baseline is established against which future monitoring data can be compared. The data collected in the noise specialist study may be used to establish a baseline environment, prior to mining activities.

3.18.2 DATA COLLECTION

Two site visits where undertaken to determine the ambient sound levels using a number of sound descriptors. A number of 10 minute measurements were taken over a day/night period from the afternoon of the 8th to the afternoon of 9th of October 2013 as well as at a later date

(18 - 22 May 2014). Ambient (background) noise levels were measured at appropriate times in accordance with the South African National Standard SANS 10103:2008 "The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication". The standard specifies the acceptable techniques for sound measurements including:

- type of equipment;
- minimum duration of measurement;
- microphone positions;
- calibration procedures and instrument checks; and
- weather conditions.

Sound level measuring equipment settings conform to specifications listed in SANS 10103 (South African Guidelines). During the site visits, there were no clearly identifiable noise sources close to the measurement location and the location should provide an overview of the sound character in the area. The sawmill was operational yet not audible at the measurement location. The microphone was located in an open area further than 5 meters from any vegetation or reflective surfaces (excluding the ground itself).

3.18.3 RESULTS

Potentially sensitive receptors, also known as noise-sensitive developments (NSDs) were identified using Google Earth®. This was supported by a site visit to confirm the status of the identified dwellings. Potential NSD's in and within approximately 2,000 meters around the proposed development were identified as **1** to **21** (presented inFigure 23) with their localities defined in Table 16 below.

Figure 23: Noise sensitivity

Table 16: Locations of the identified noise-sensitive developments (Datum type: WGS84 – Hartbeeshoek)

Noise-sensitive development	Status	Location (Latitude)	Location (Longitude)
NSD01	Residential	-26.8616	30.2766
NSD02	Residential	-26.8559	30.28716
NSD03	Residential	-26.8792	30.30454
NSD04	Residential	-26.8473	30.28829
NSD05	Residential	-26.8558	30.27984
NSD06	Residential	-26.836	30.31634
NSD07	Residential	-26.8562	30.28073
NSD08	Residential	-26.8547	30.27827
NSD09	Residential	-26.8589	30.33176
NSD10	Residential	-26.8505	30.28644
NSD11	Residential	-26.8529	30.28674
NSD12	Residential	-26.8429	30.33131
NSD13	Residential	-26.8878	30.29809
NSD14	Residential	-26.8871	30.28322
NSD15	Residential	-26.8507	30.28443
NSD16	Residential	-26.885	30.31542
NSD17	Residential	-26.885	30.31358
NSD18	Residential	-26.8856	30.31284
NSD19	Residential	-26.8812	30.30638
NSD20	Residential	-26.8607	30.33309
NSD21	Residential	-26.8625	30.33379

The pre-mining noise environment resembles a rural atmosphere but does have slightly elevated ambient noise levels. Measured data indicate sound levels typical of an area with a rural district sound character with wind and agricultural activities raising the sound levels. The dominant source of noise is natural, mainly wind induced noises and birds.

During the daytime $\mathbf{L_{Aleq}}$ values ranged between 35.7 and 59.2 dBA. The night-time $\mathbf{L_{Aleq}}$ values ranged between 29.2 to 55.9 dBA. The average value of the 84 10-minute equivalent daytime measurements was calculated at 46.1 dBA, while the average for the 48 night-time measurements were calculated at 38.6 dBA.

Daytime measured data indicate sound levels typical of an area with a rural to sub-urban district character. Night-time levels however are far higher than expected for such an area, likely due to sounds from both the cattle farming activities as well as insects and frogs.

The measured $L_{Aeq,f}$ levels during the day and night however conforms to the recommendation of 55 and 45 dBA respectively by the World Health Organization, World Bank and International Finance Corporation for residential use.

3.18.3.1 Site Sensitivities and Constraints

Based on the location of the proposed mining development and the potential noise-sensitive developments there exists a low risk of a noise impact on these receptors.

Site constraints consist of the neighbouring communities and the two schools in the surrounding areas which could be seen as sensitive receptors within the landscape.

3.18.4 CONCLUSION

All the measurements indicated an area that is generally quiet. The dominant source of noise is natural being mainly wind induced noises and birds. Vehicle movement and agricultural activities (such as the cutting and moving of trees and livestock related sounds) will impact and increase these sound levels. Measured data indicate sound levels typical of an area with a rural district sound character with wind and agricultural activities raising the sound levels. The measured $L_{Aeq,f}$ levels during the day and night however conforms to the recommendation of 55 and 45 dBA respectively by the World Health Organization, World Bank and International Finance Corporation for residential use. Based on the location of the proposed mining development and the potential noise-sensitive developments there exists a low risk of a noise impact on these receptors.

3.19 BLASTING AND VIBRATION

Blast Management and Consulting was appointed by EIMS to undertake the blasting and vibration specialist study for the Leiden project. The following sections provide a summary of the potential effects of blasting at the proposed Leiden project. Information has been sourced from the Blast Management EIA report. For further information, please refer to the full blasting and vibration EIA report which is included in Appendix Q.

3.19.1 INTRODUCTION

Explosives are used to break rock through the shock waves and gasses yielded from the explosion. The application of explosives for breaking rock will always have an effect on the surrounding environment. These effects can manifest in the form of ground vibration, air blast, fumes, fly rock etc. These short duration events may be noticeable by communities and individuals living in the immediate environment. These events tend to cause nuisance and elicit an emotive response because of resonance because they are easily recognized as being related to blasting.

3.19.1.1 Ground Vibration

Ground vibration is a natural result from blasting activities. The far field vibrations are inevitable, but un-desirable by products of blasting operations. The shock wave energy that travels beyond the zone of rock breakage is wasted and could cause damage and annoyance. The level or intensity of these far field vibration is however dependant on various factors. Some of these factors can be controlled to yield desired levels of ground vibration and still produce enough rock breakage energy. Factors influencing ground vibration are the charge mass per delay, distance from the blast, the delay period and the geometry of the blast. These factors are controlled by planned design and proper blast preparation.

3.19.1.2 Air Blast

Air blast or air-overpressure is pressure acting and should not be confused with sound that is within audible range (detected by the human ear). Sound is also a build up from pressure but is at a completely different frequency to air blast. Air blast is normally associated with frequency levels less than 20 Hz, which is the lower limit threshold for human hearing. Air blast is the direct result from the blast process although influenced by meteorological conditions. The final blast layout, timing, stemming, accessories used, covered or not covered etc. all has an influence on the outcome of the result. Air blast is more commonly a problem to nearby communities than vibration, because it is felt through response of large surfaces such as ceilings and windows. Typically these effects can be confused as being caused by ground vibration.

3.19.1.3 Fly Rock

Blasting practices require some movement of rock to facilitate the excavation process. The extent of movement is dependent on the scale and type of operation. For example, blasting activities within large coal mines are designed to cast the blasted material much greater distances than practices in a quarrying or hard rock operations. This movement should be in the direction of the free face, and therefore the orientation of the blasting is important. Material or elements travelling outside of this expected range may be considered to be fly rock. An incorrect blast design may result in blast rock. In short the following list is typical causes of fly rock:

- Burden to small,
- Burden to large,
- Stemming length to short,
- Out of sequence initiation of blastholes,
- Drilling inaccuracies,
- Incorrect blasthole angles,

- Over charged blastholes.

It is however possible to blast without any fly rock with proper confinement of the explosive charges within blast holes using proper stemming procedures and materials. Stemming is the key requirement here to ensure that explosive energy is efficiently used to its maximum.

3.19.2 DATA COLLECTION

Data was obtained from literature from the area and review of aerial images and maps to identify installations, houses and structures as points of interest to consider. A site visit was under taken in September 2013 to confirm the site surroundings and potentially affected infrastructure. The site visit also aimed to identify and define an area of possible influence.

The protocols applied in this study were based on the author's experience, guidelines from literature research, client requirements and general indicators from the various acts of South Africa. There is no direct reference in the South African legislation with regards to requirements and limits on the effect of ground vibration and air blast specifically. There are also no specific South African standards and the USBM is well accepted as standard for South Africa. The guidelines and safe blasting criteria are according international accepted standards and specific applied in this document is the United States Bureau of Mines (USBM) criteria for safe blasting for ground vibration and recommendations on air blast.

3.19.3 RESULTS

A review of potentially sensitive features in the project application area is required when considering blasting and vibration, this is because of the effects ground vibration levels, air blast levels and fly rock have to the surrounding environment. Detail review of the area and site visit conducted showed various structures and installations located within the 3500m possible influence boundary. These potentially sensitive features are presented in Figure 24.

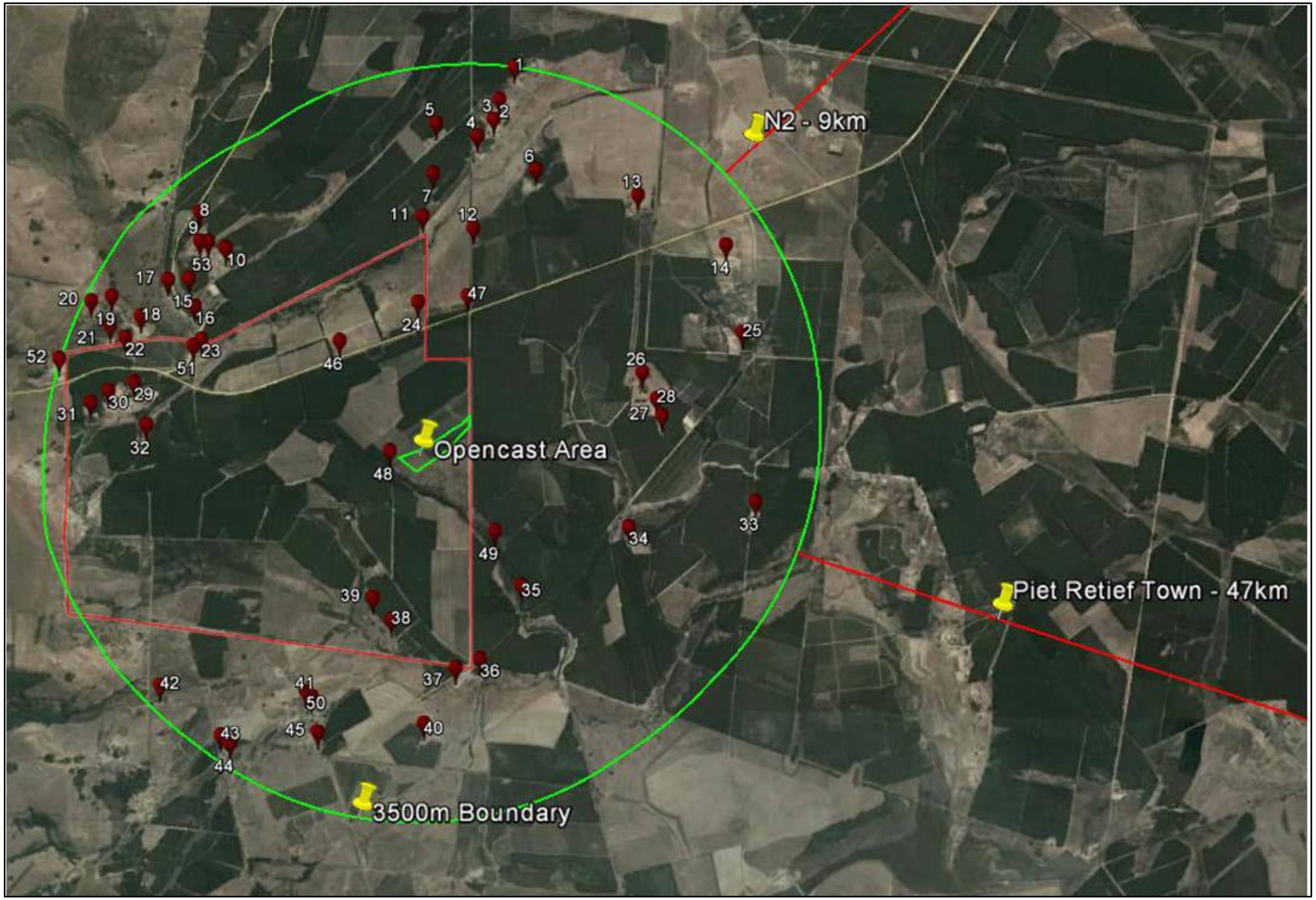


Figure 24: Aerial image indicating potentially sensitive features in terms of blasting and vibration

The structures range from typical traditional built housing to brick and mortar structures. Structures also range between houses and industrial installations. Table 17 shows some of the structures observed in the area.

Table 17: Sensitive features located within the study

Structures	Short Description
	Traditional building style houses
	Old Sandstone building on farm

	School Buildings
	Weir in one of the streams

3.19.3.1 Site Sensitivities and Constraints

Based on the location of the proposed mining development, blasting and vibration are considered to be a low risk impact on the surrounding sensitive receptors within the area.

Site constraints consist of the neighbouring communities and the two schools in the surrounding areas which could be seen as sensitive receptors within the landscape.

3.19.4 CONCLUSION

The application of explosives for breaking rock will always have an effect on the surrounding environment. These effects can manifest in the form of ground vibration, air blast, fumes, fly rock etc. These short duration events may be noticeable by communities and individuals living in the immediate environment. The study area is considered to be a moderately sensitive area with POI's present in the surroundings. It is expected that the most critical area is the 1500 m around the project area. Depending on the final blasting operation scale, the installations within this boundary are expected to be possibly impacted. Installations further than 1500 m from blasting operations is certain to be impacted to lesser degree but will need consideration as well. It is important to note that impacts arising from blasting may be attributed mainly to blast designs, and it is generally possible to successfully mitigate the impacts of blasting with the correct blast design for each blast.

3.20 TRAFFIC

ITS Engineering was appointed by EIMS to undertake the traffic specialist study for the Leiden project. The following sections provide a summary of the traffic environment that may be affected by the proposed Leiden project. Information has been sourced from the ITS EIA report. For further information, please refer to the full traffic EIA report which is included in Appendix R.

3.20.1 INTRODUCTION

The purpose of a traffic study is to assess the potential impact of traffic generated by the propose project and to identify the improvements and mitigation measures required to ensure that the road network will operate safely and efficiently for the duration of the proposed project. It is important to include traffic considerations when assessing land use alternatives, especially when the propose project may have a significant impact on traffic operations within the immediate vicinity of the project and within the overall transportation network of the surrounding area.

The traffic assessment should provide the following:

- A basis on which to assess the transportation implications of the proposed project;
- A rational basis on which to evaluate if the type and scale of the proposed development is appropriate for the site and what improvements may be necessary, on and/or off of the site, to provide for safe and efficient traffic flow;
- A basis for assessing existing or future localized transportation system deficiencies which should be improved; and
- An assessment of transportation-related issues associated with the proposed project that may be of concern to neighbouring residents, businesses, and property owners.

In terms of potential impacts the proposed project will result in increased use of the local road network which may result in the deterioration of road surfacing, damage to bridges and culverts in the area, and safety risks to surrounding communities.

3.20.2 DATA COLLECTION

The baseline assessment included the identification of the affected external roads and the investigation and assessment of the status quo of external road networks including the existing traffic volumes. A site visit was conducted on the 22nd August 2013 to obtain a preliminary understanding of the current traffic conditions. Baseline traffic volumes were obtained from the Comprehensive Traffic Observation (CTO) Data 2012. The baseline assessment of the transportation aspects related to the proposed mine activities was determined based on the evaluation of the worst traffic scenario during the construction, operation, closure and decommissioning phases.

3.20.3 RESULTS

Leiden is located between the towns of Piet Retief and Ermelo in the Mpumalanga province. The national N2 road is a surfaced two lane Provincial Class 2 major road that runs north-south and connects Ermelo with Piet Retief. The site connects to the N2 via two gravel roads. “Gravel Road 1” runs in a north-south direction while “Gravel Road 2” runs in an east-west direction, as indicated in Figure 25. The Mashala Leiden Coal Mine will have access at an intersection with Gravel Road 2 ±18km from the N2. The access will be linked to the internal haul roads within the mining area.

The N2 Road is part of the national road network and the Mpumalanga Department of Roads and Transport (MDRT) control the maintenance of this road. The road is paved and the surface condition is fairly adequate. The AM Peak was found to be from 7:00 to 8:00 and the PM Peak hour was recorded from 16:00 to 17:00. CTO Data 2012 indicates the following:

- The total number of vehicles on the N2 Road is 2 734 (both directions, 14 days or 3.8% of the year counted);
- Average Daily Traffic (ADT): 3 064 vehicles;
- Average Daily Truck Traffic (ADTT): 815 vehicles;
- Heavy Vehicles (HV): 26.6% (815 vehicles).

Figure 25: Traffic sensitivity

Gravel Road 1 runs approximately 15 km from the N2 road to the Leiden site. This road is a public road and is maintained by the Mpumalanga Department of Roads and Transport (MDRT). The road runs in a north-south direction. It is a narrow single lane carriageway with an unpaved gravel surface. This gravel road will be difficult to negotiate during the rainy session as it has a number of low water bridge crossings. The surface is in poor condition and would require resurfacing to be usable. Traffic volumes are currently low on this road. Increased traffic volumes on the gravel road will impact negatively on villages, schools and the forestry business nearby in terms of noise, dust, and safety of pedestrians.

Gravel Road 2 runs approximately 18 km from the N2 to the Leiden site. The first 1.5 km from the N2 intersection is surfaced, after which the road is unpaved gravel. This road is a public road and is maintained by the MDRT. It connects the N2 with the forestry area and local farms in an east-west direction. The surface condition will be a challenge during the wet seasons of the year and surfacing of this road would be required. The road is a narrow single carriageway with low traffic volumes. Increased traffic volumes on this road will impact negatively on villages, schools, and the forestry business close to the road in terms of noise, dust, and safety of pedestrians.

The nearest rail network is located east of the N2 Road with stations at Sheepmoor and Panbult. This rail network is the main rail link between Gauteng and the Richards bay export harbour and is mainly used for the export of coal. The line feeds large volumes of bulk traffic between Gauteng and Richards bay.

The traffic volumes on the gravel roads are mainly the result of traffic from the local plantations in the area to the Busby Saw Mill and Panbult railway station, with less than 10 vehicles per hour in both directions during the morning and afternoon peak hours. The traffic generated by the proposed Leiden Coal Mine will be distributed along the existing road network and sufficient capacity exists on the road network to accommodate the proposed development traffic volumes.

The following receptors might be affected by the proposed development:

- Increased traffic volumes on existing gravel roads and the N2 national route;
- The existing forestry operations in the area;
- Small villages close to Gravel Road 1;
- School close to Gravel Road 1; and
- School close to Gravel Road 2.

The desktop and inception assessment did not identify any potential fatal flaws or critical issues associated with a new development in the area. The assessment did not identify any "No Go" areas or buffer zones in terms of the existing road network and access roads.

3.20.3.1 Site Sensitivities and Constraints

The following receptors might be affected by the proposed development:

- Increased traffic volumes on existing gravel roads and the N2 national route;
- The existing forestry operations in the area;
- Small villages close to Gravel Road 1;
- School close to Gravel Road 1; an
- School close to Gravel Road 2.

The desktop and scoping level assessment did not identify any potential fatal flaws or critical issues associated with a new development in the area. No legislated constraints were identified during the EIA level assessment either.

3.20.4 CONCLUSION

The proposed site will be accessed via either Gravel Road 1 or Gravel Road 2, both of which link from the N2. From the desktop assessment it was established that both access roads are local gravel roads providing access mainly to the forestry activities. Both access roads will be difficult to negotiate during the wet seasons of the year and regular maintenance would be require in terms low water bridge crossings and dust control. However Gravel Road 1 will be difficult to negotiate even in dry weather and has several water crossings. Gravel Road 2 is already utilised by forestry trucks which indicates that the road is designed to handle heavy loads. In terms of social considerations, the school located next to Gravel Road 1 is much closer to the road than the school near Gravel Road 2. This makes Gravel Road 2 the preferred option from a social perspective.

3.21 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION AND/OR REMEDIATION

Environmental aspects both within the application and surrounding area that may require protection or remediation are listed below. These aspects have been identified and based on the information contained in the description of the baseline receiving environment in Sections 3.1 to 3.20. Furthermore, these environmental aspects that may require protection or remediation have been included in the action plan and technical management measures contained in Section 21.

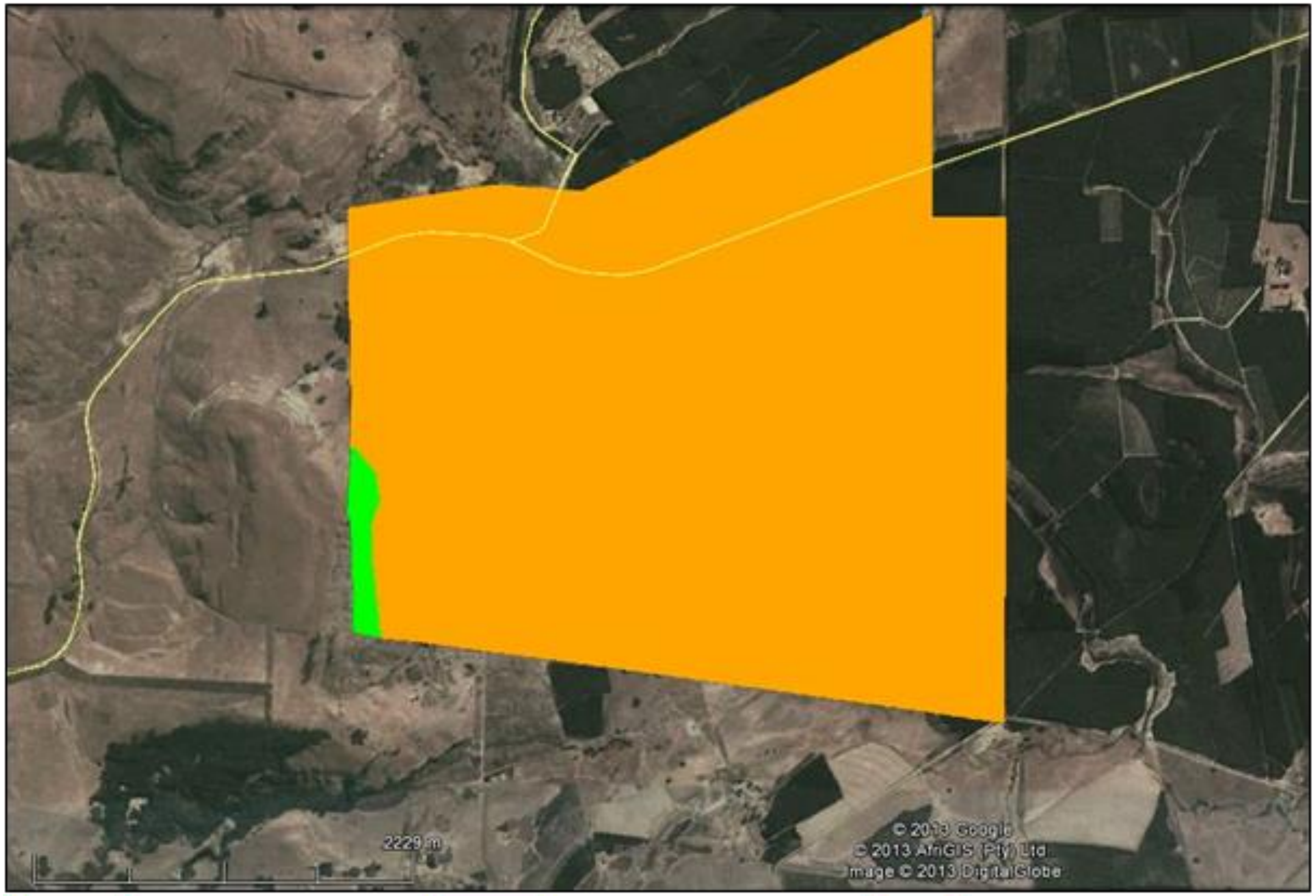
Table 18: Environmental aspects requiring protection

Aspect	Feature
Topography	Surface drainage lines
Ground water	Ground water resources (such as aquifers)

Aspect	Feature
	Ground water quantity
	Ground water quality
	Wetlands and pans
Surface Water	Surface water resources (such as streams and pans)
	Surface water quantity
	Surface water quality
	Wetlands and pans
Biodiversity	Species of concern (flora and fauna)
	Primary vegetation units
	Wetlands and pans
Soils	Stripped and stockpiled soils
	Soils of moderate to high agricultural potential
Land Use	Forestry
	Sawmill
Land Capability	Agricultural potential
	Grazing potential
Air Quality	Ambient air quality
Noise Environment	Ambient noise levels
Social	Livelihoods
Economic	Employment at alternative land uses
Heritage and Cultural	Palaeontological features
	Stillborn Babies

Aspect	Feature
Visual	Sensitive viewer locations

3.22 MAPS SHOWING THE SPATIAL LOCALITY AND AERIAL EXTENT OF ALL ENVIRONMENTAL FEATURES



	Low Sensitivity		**Moderate Sensitivity**		**High Sensitivity**

Figure 26: Palaeontological sensitivity

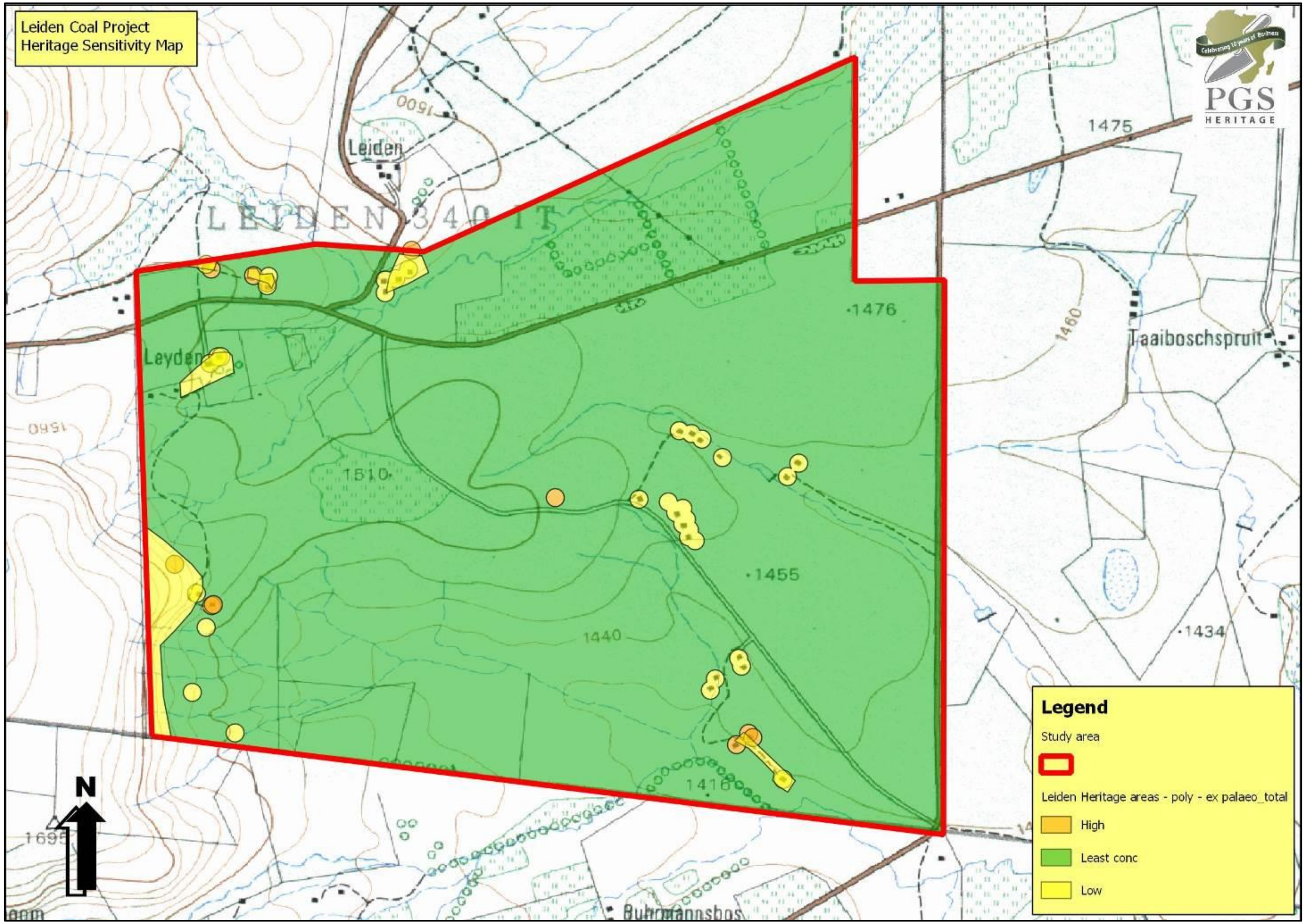


Figure 27: Heritage features

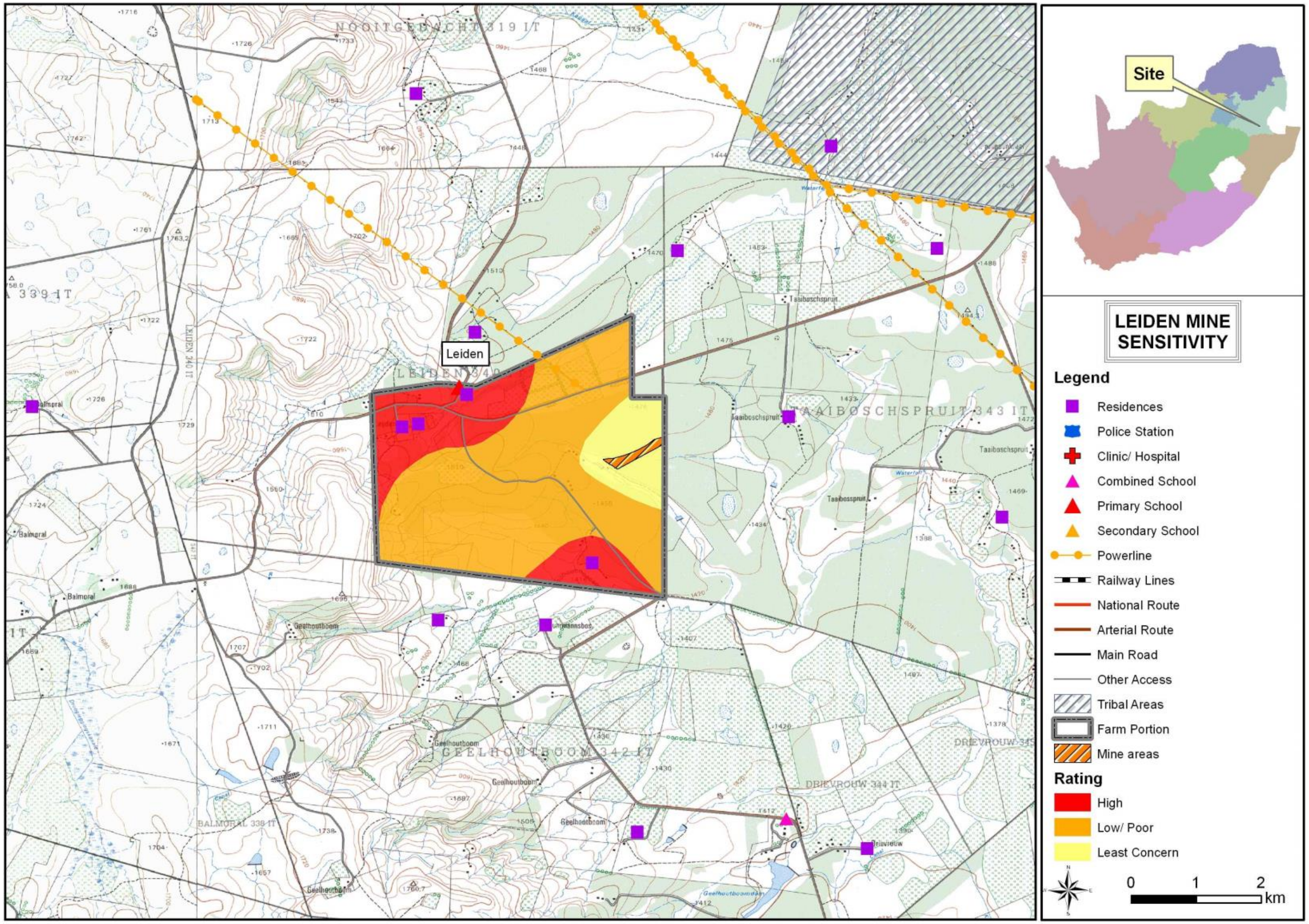


Figure 28: Social sensitivity

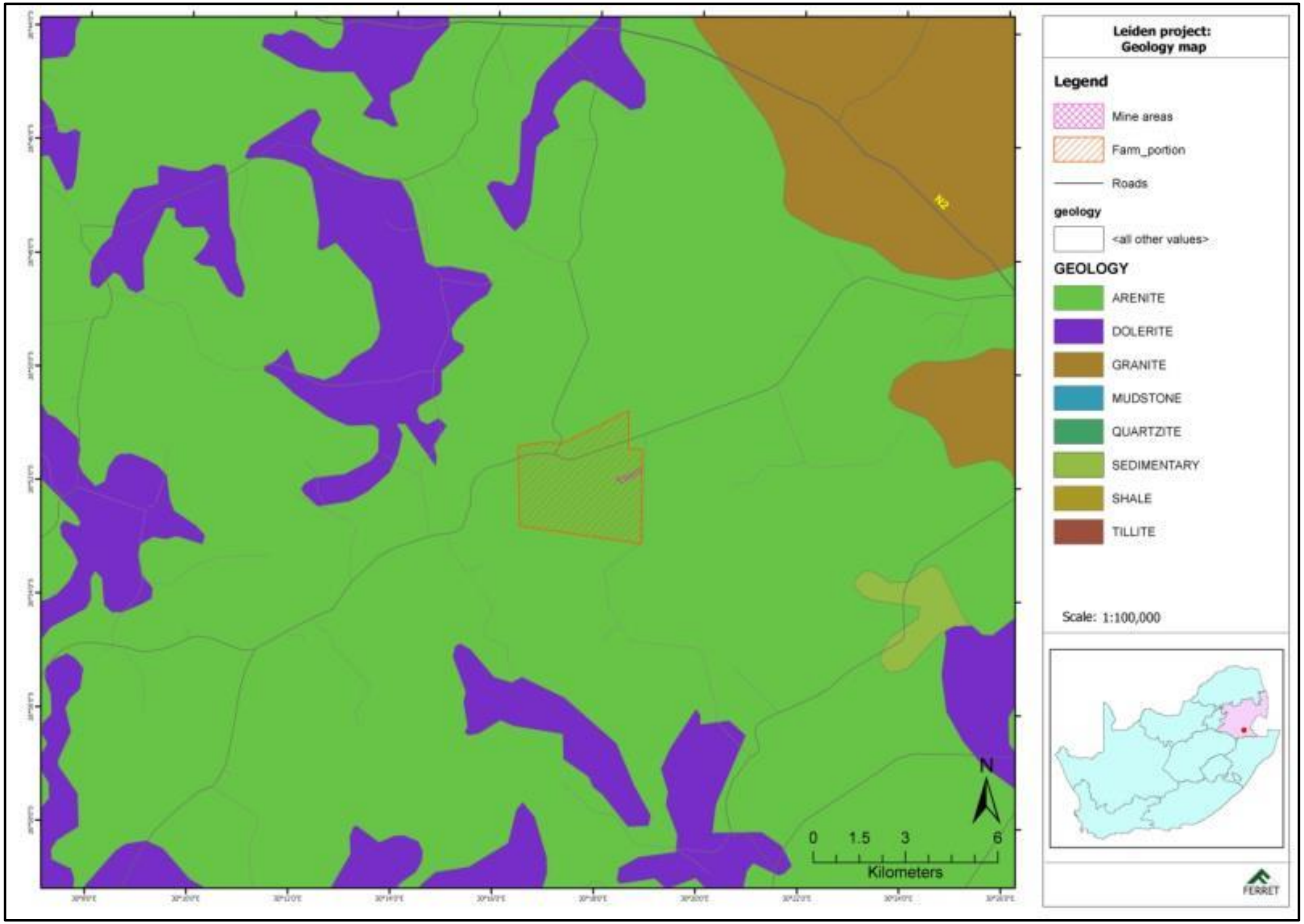


Figure 29: Geology of the site

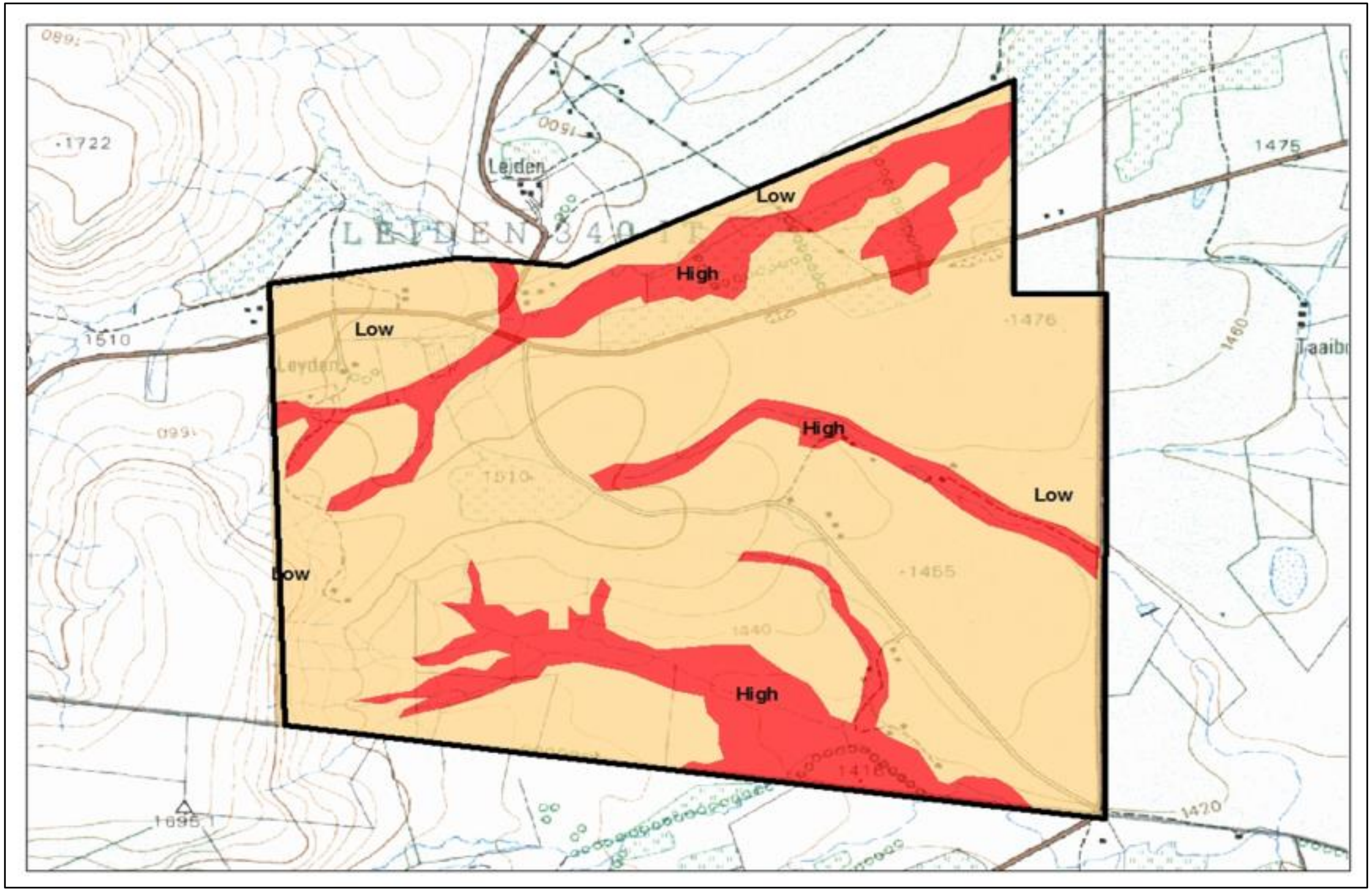


Figure 30: Soil sensitivity

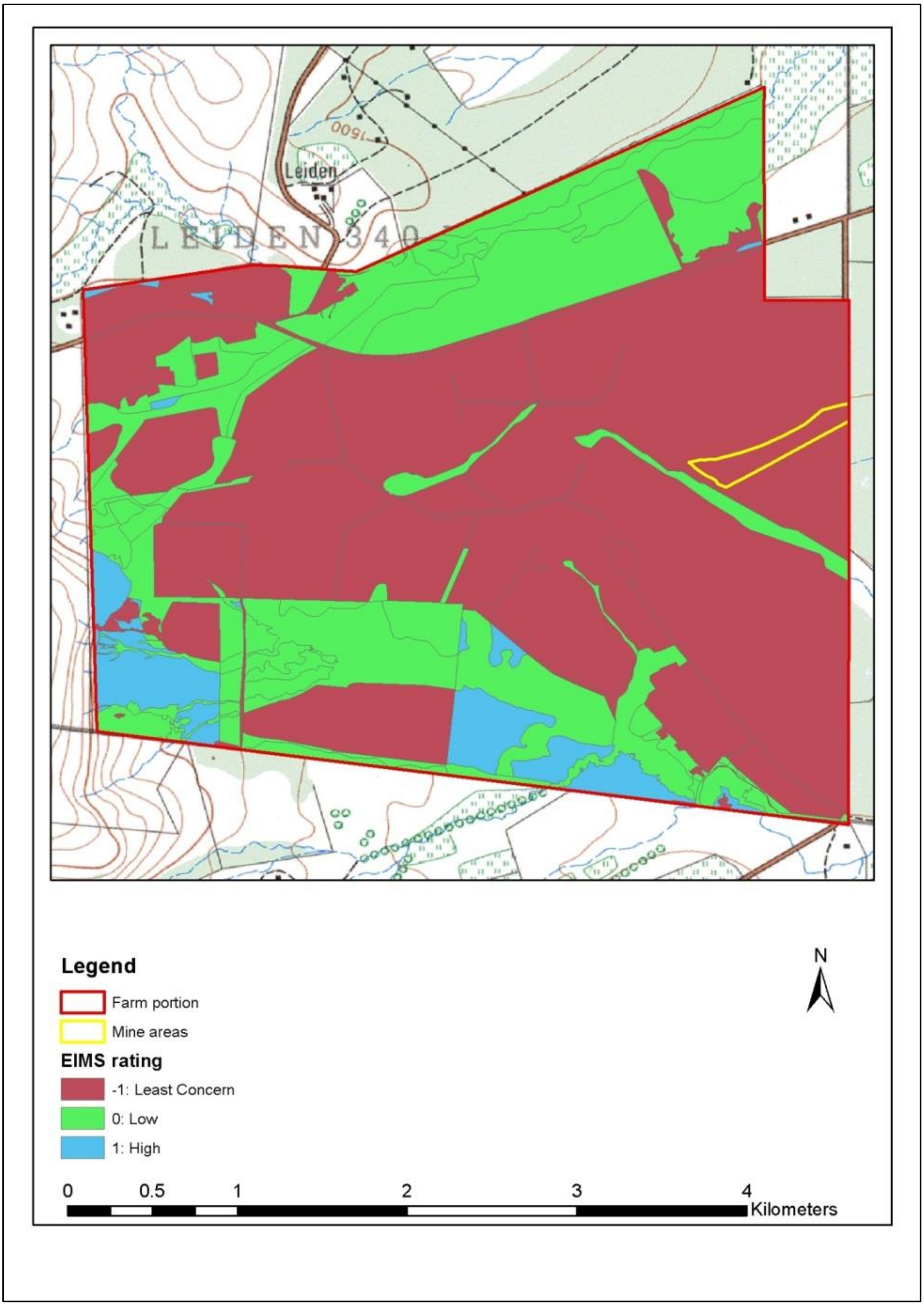


Figure 31: Floral sensitivity

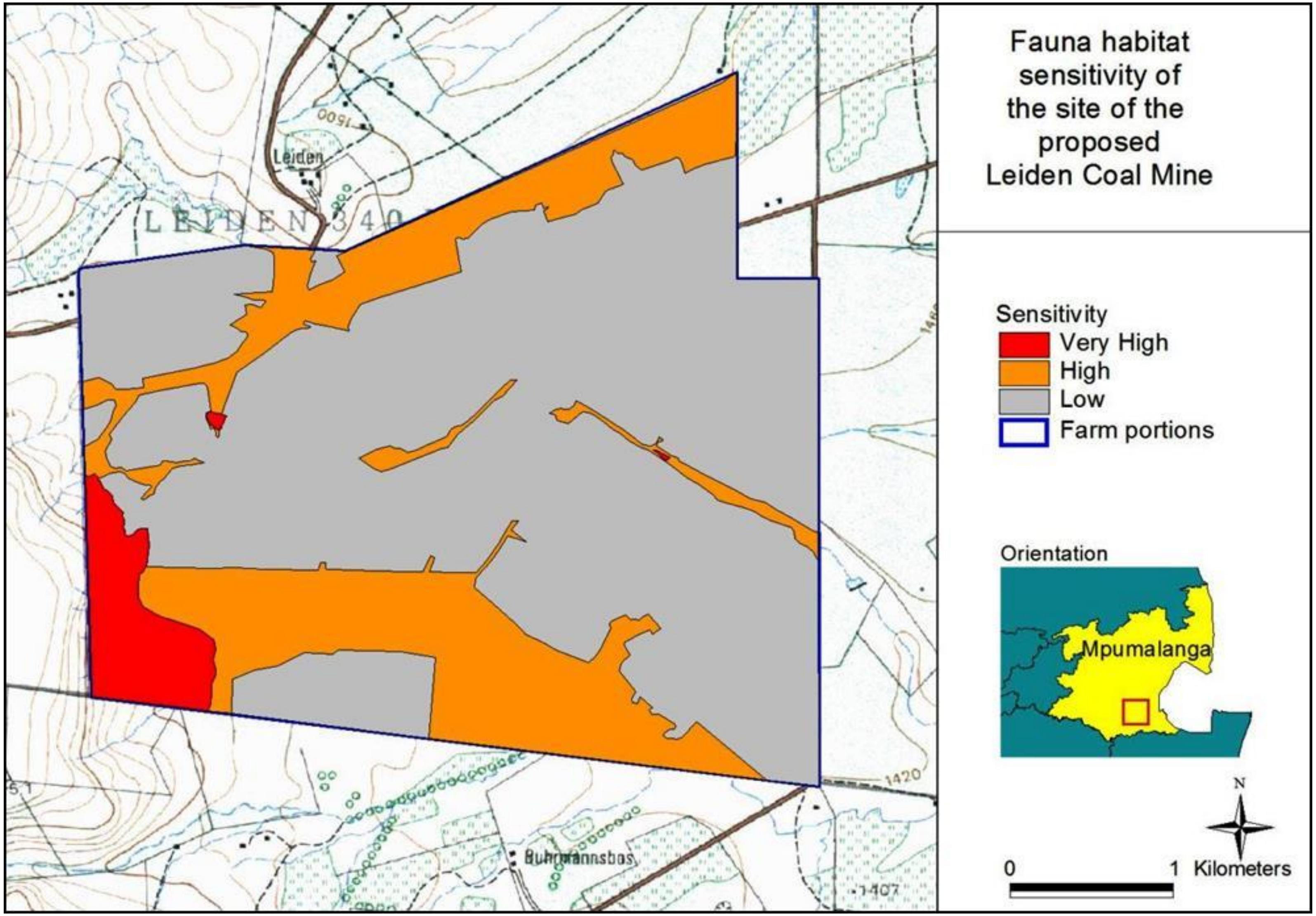


Figure 32: Faunal sensitivity

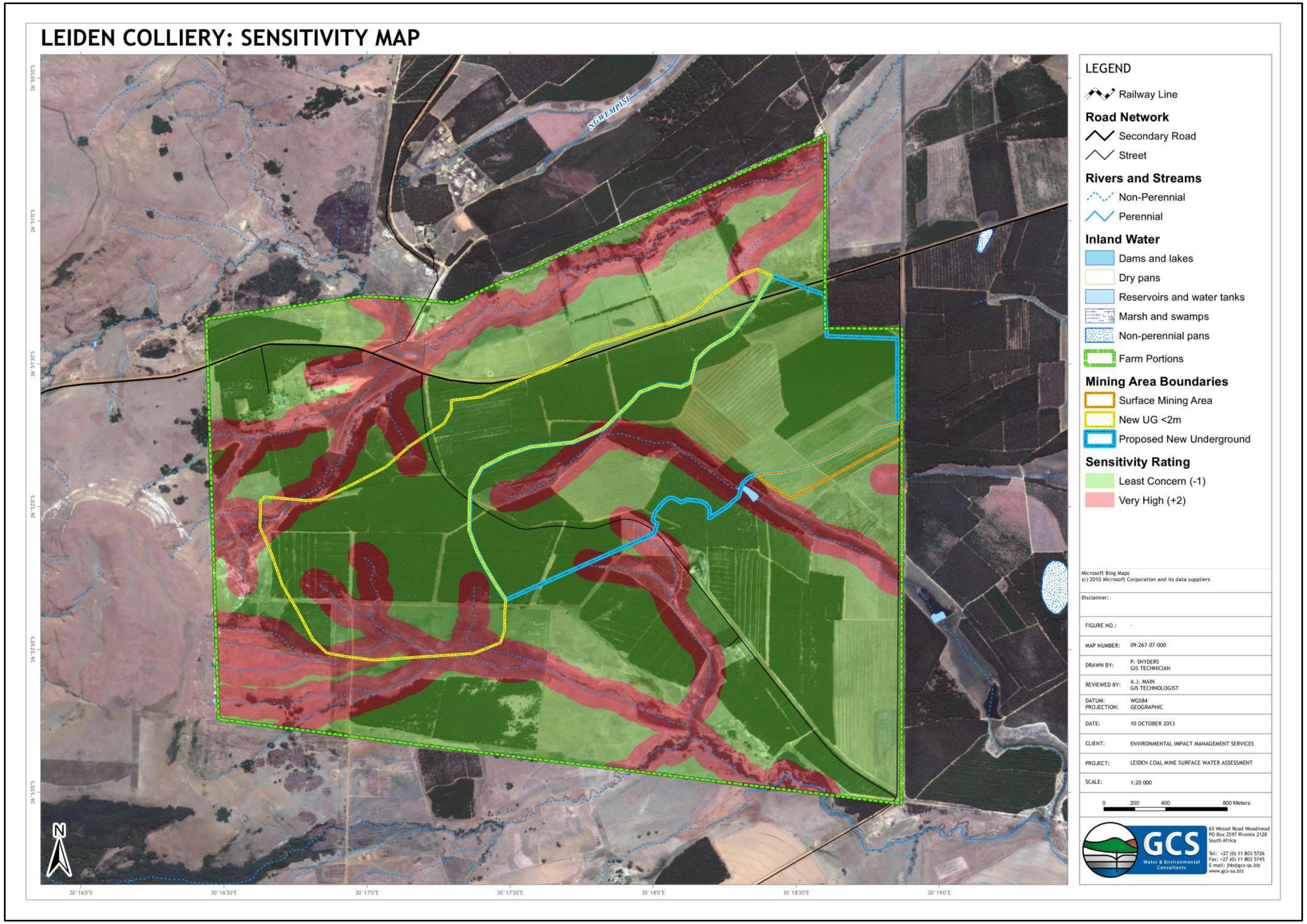


Figure 33: Surface water features

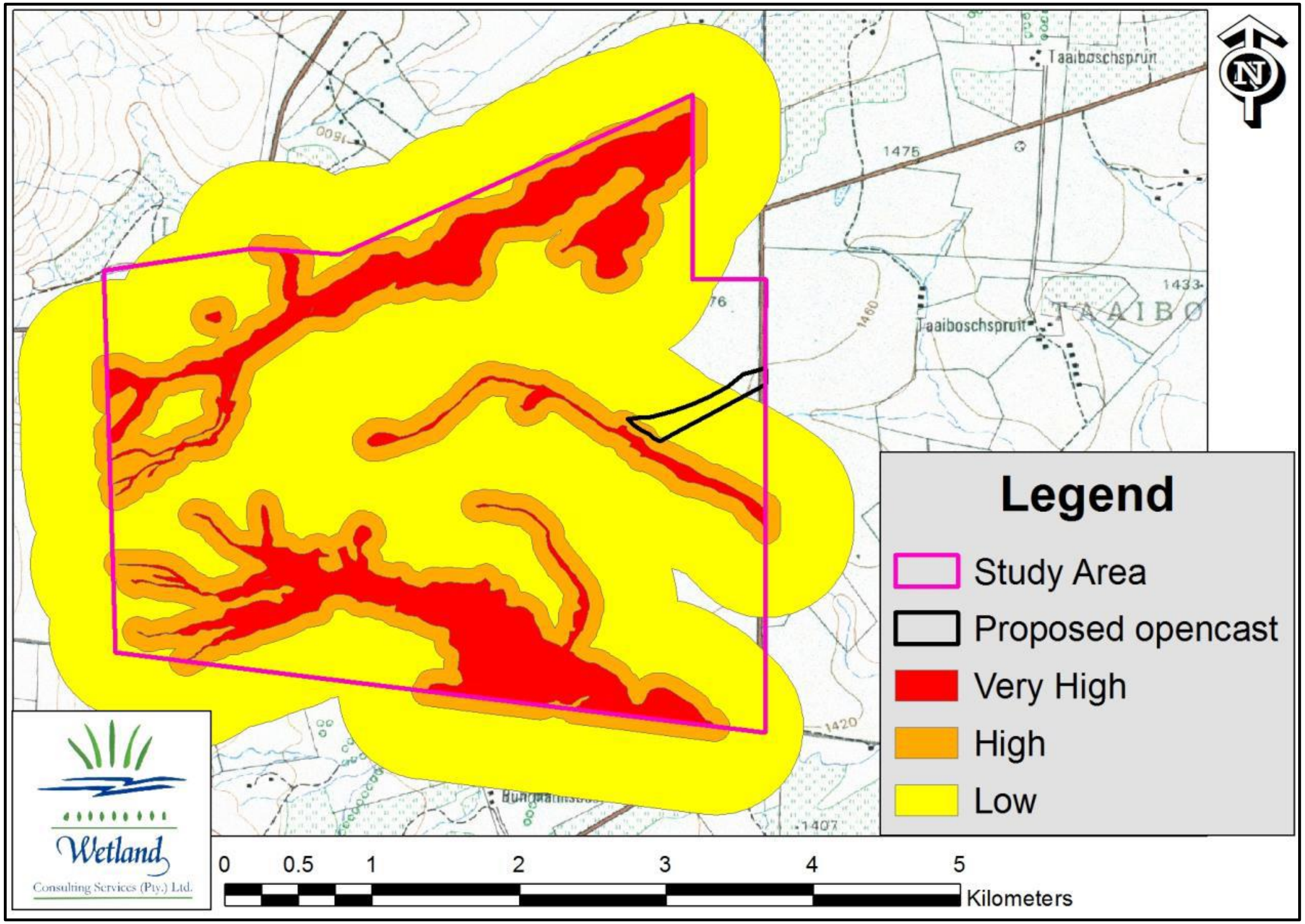


Figure 34: Wetland sensitivity

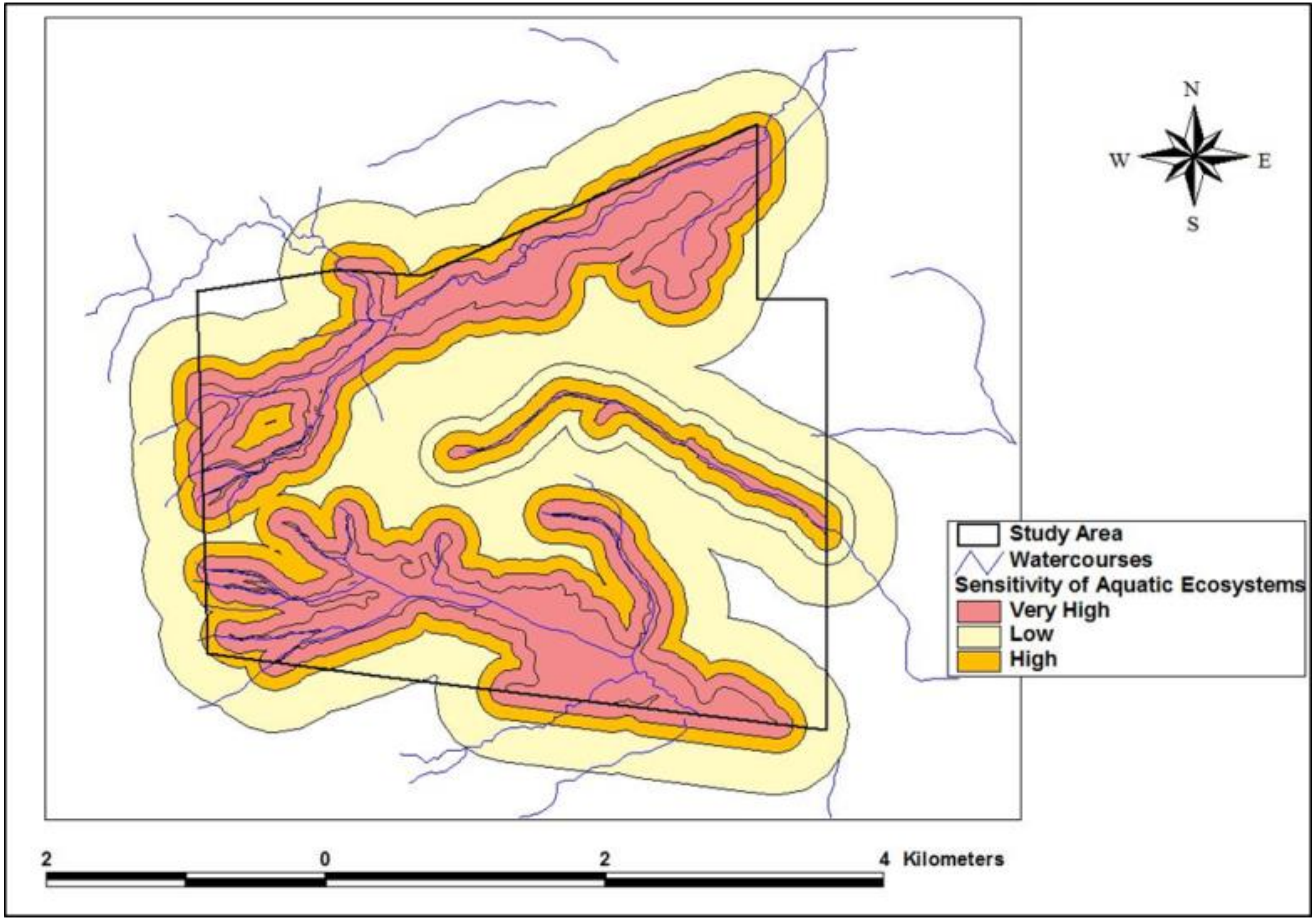


Figure 35: Aquatic ecology sensitivity

Figure 36: Ground water sensitivity

Figure 37: Air quality sensitive features

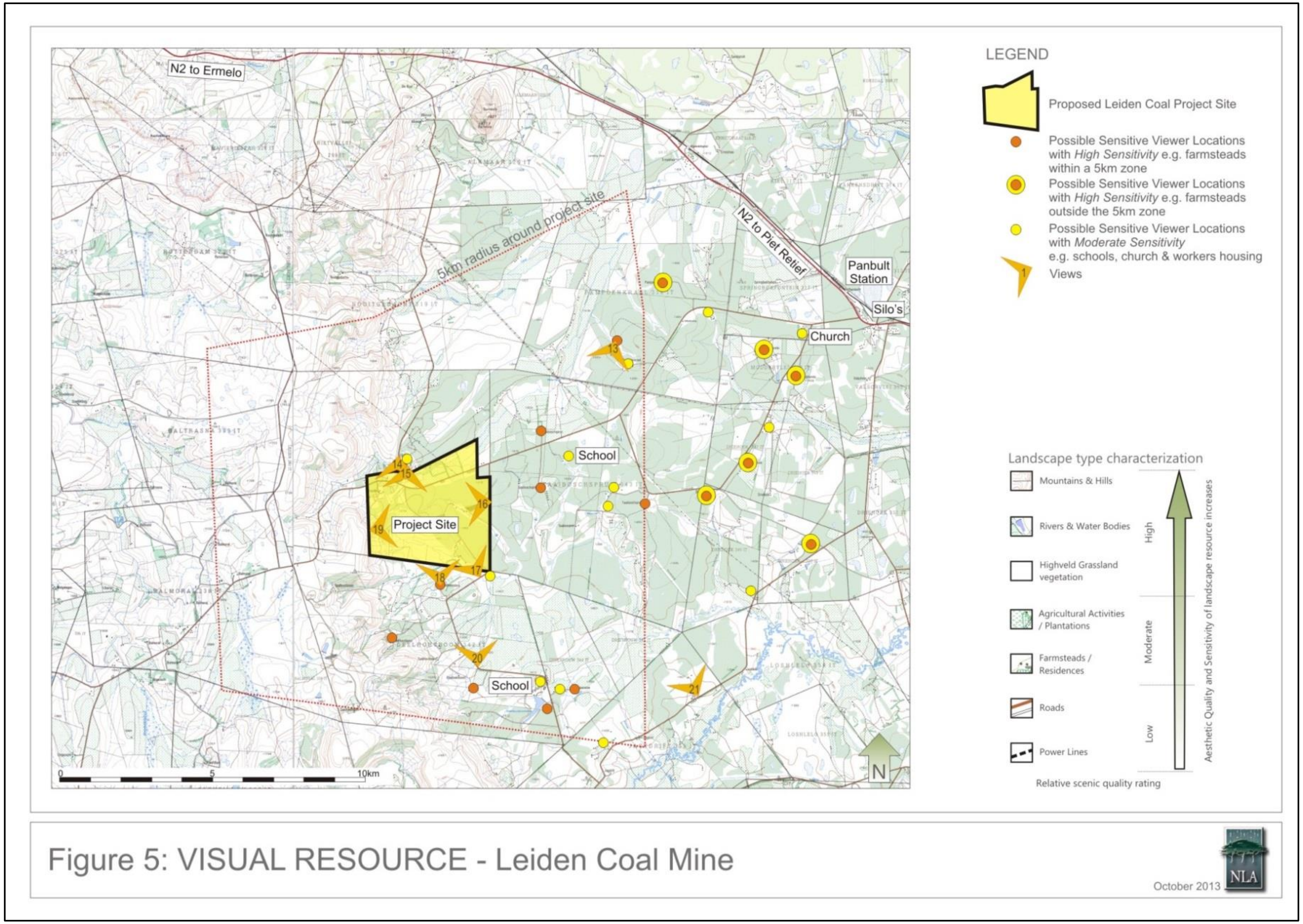


Figure 38: Visual resource

Figure 39: Noise sensitive features

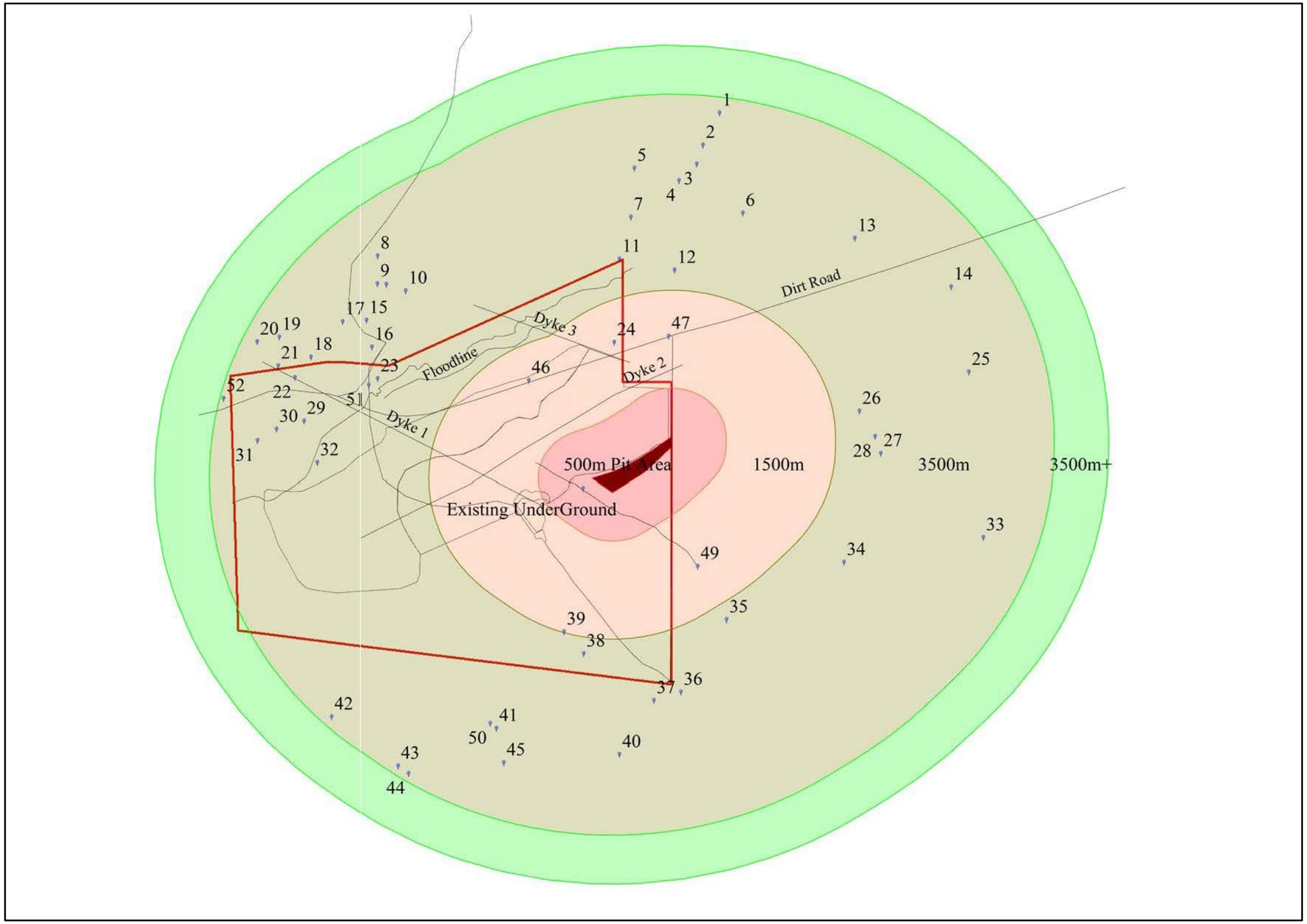


Figure 40: Blasting sensitivity radius

Figure 41: Traffic sensitivity

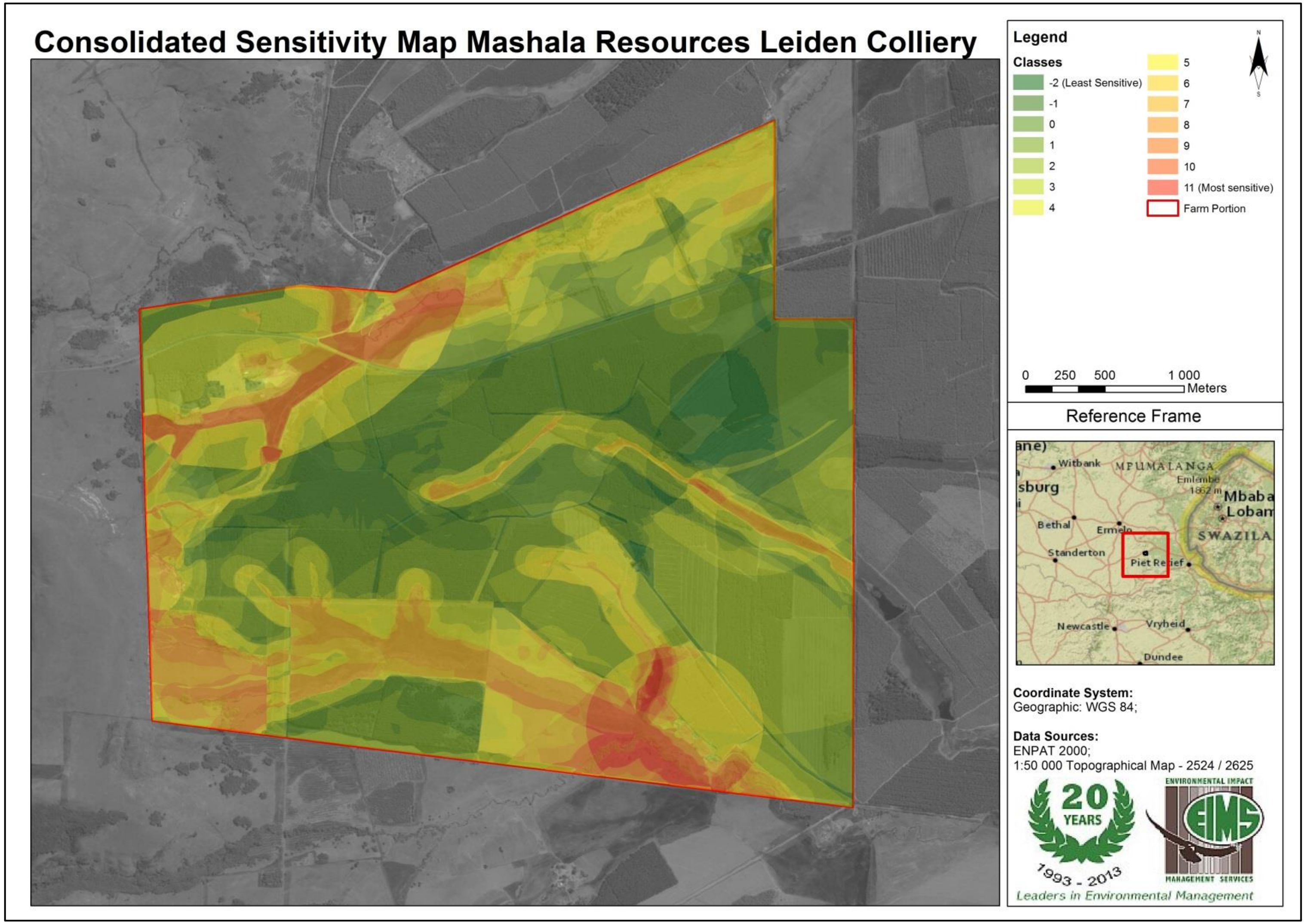


Figure 42: Combined sensitivity of the site

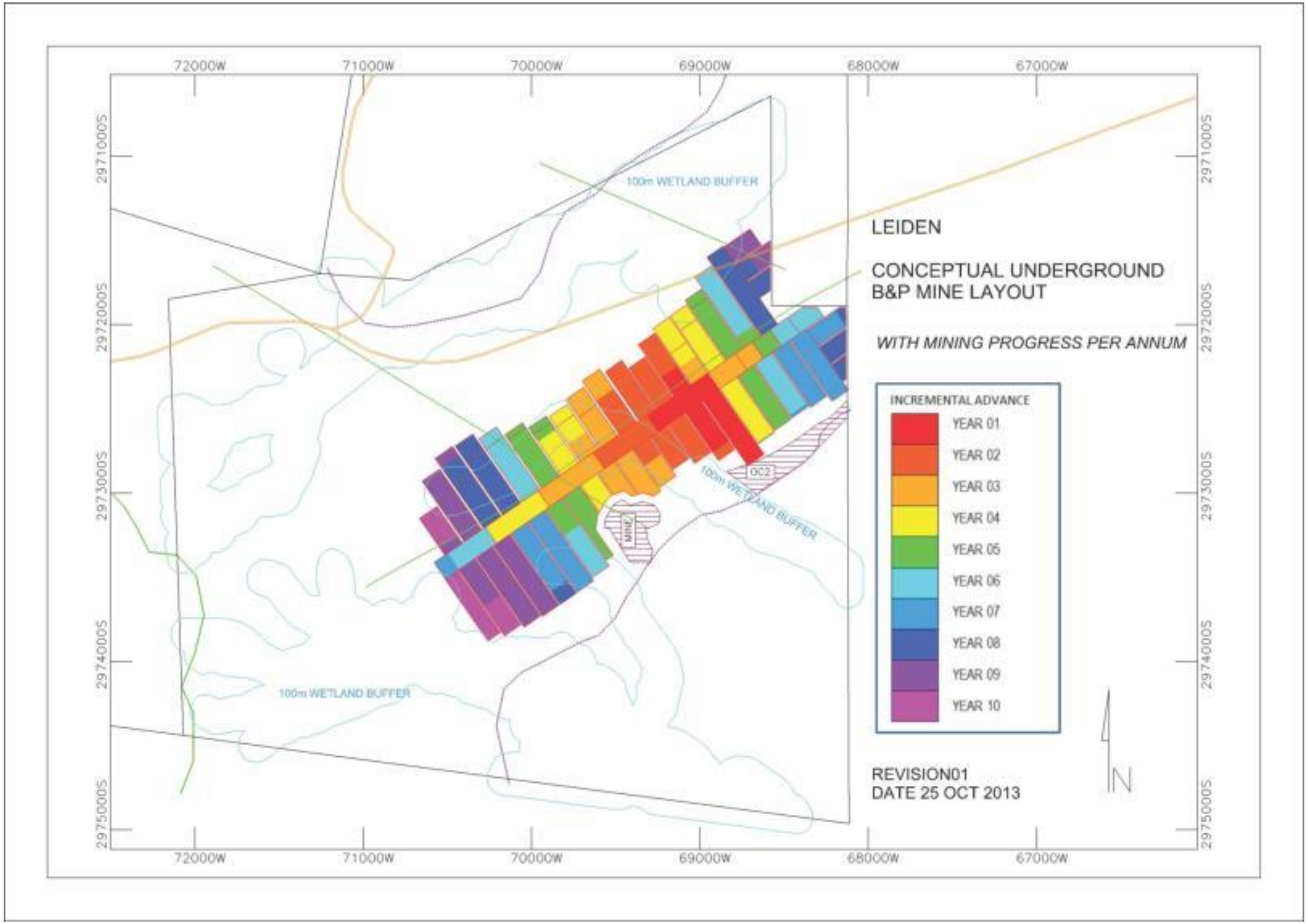


Figure 43: Mining schedule

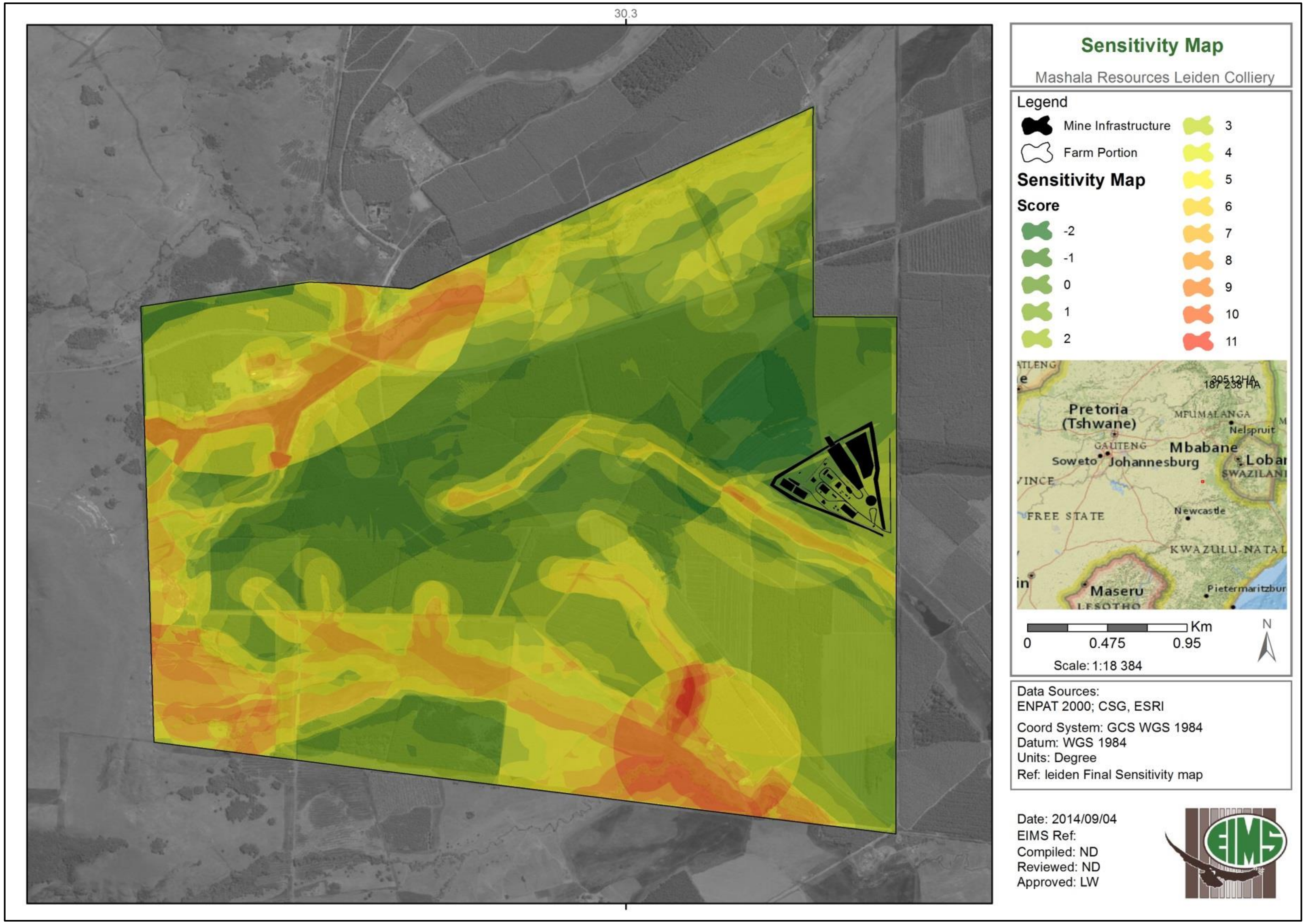


Figure 44: Final sensitivity map

4 PROPOSED MINING OPERATION DESCRIPTION

The section below provides a detailed project description. The aim of the project description is to indicate the activities that are planned to take place at the proposed Leiden Coal Mine. Furthermore, the detailed project description is designed to facilitate the understanding of the project related activities which result in the impacts identified and assessed and for which management measures have been designed.

4.1 THE MINERAL RESOURCE

The proposed Leiden Coal Mine is located within the Ermelo Coalfield. The coal seams have been logged as the Utrecht seams of the Gus and Dundas seams. From a stratigraphic perspective, the Gus seam lies above the Dundas seam with a parting of approximately 15 m. The Gus seam occurs at a depth of approximately 30 m from the surface with an average width of 0, 70 m while the Dundas seam occurs at a depth of 45 m from the surface with an average width of 1.45 m. Faults and dolerites are known to occur within the project area and have been intersected.

4.2 MINE PRODUCTION RATE

The proposed Leiden Coal mine will ideally employ a combination of open-cast and underground mining methods. The operation is aimed at mining coal seams from a reserve of approximately 2 199 404 saleable tonnes of coal from a depth of between 15-55 m which is located in the Vryheid Formation of the Karoo Supergroup. The anticipated Life of Mine (LoM) is 10 years but this could be further extended if additional reserves are to be exploited at a later stage. As such, the proposed Leiden Coal Mine will target a Run of Mine (RoM) production rate of 18 000 tonnes per month. The majority of the coal will be export quality thermal coal. All RoM from the proposed Leiden Coal Mine will be transported via truck to the Delta Processing and Dispatch Centre (Delta) in Ermelo where all mineral processing and mineralised waste disposal will take place.

4.3 MINING METHOD TO BE EMPLOYED

The proposed Leiden Coal mine will ideally employ a combination of open-cast and underground mining methods. It is important to note that the development alternatives assessed in this report also include an assessment of the use of both mining methods and a recommendation on which is preferred from an environmental perspective. Regardless, a description of both methods that can potentially be employed are described further below.

4.3.1 OPEN CAST MINING

The proposed open-cast section of up to 22 ha will be mined using the rollover and bench/boxcut mining method. The bench/boxcut will be constructed near the centre of the open-cast in order to facilitate exposure of the highwall and allow for access to the underground reserves. The open-cast operation is initiated by the stripping of topsoil to expose the overburden of the proposed bench/boxcut. The topsoil, subsoil and wetland soils will be hauled to a designated area to be used for rehabilitation at a later stage. Topsoil, subsoil, and wetland soil will be stockpiled separately and no mixing of stockpiled soils will occur. The anticipated strip ratio is estimated at 10:9.

Once the topsoil is removed and stored appropriately, the overburden of the proposed bench/boxcut is then drilled, blasted and removed in order to mine benches approximately 40 m wide and down to the Dundas coal seam. The annual estimated production rate of the open-cast is estimated at 20 000 tonnes per month for a period of 24 months. All RoM will be transferred by conventional haul and load operations to the onsite mobile crusher and then stockpiled for transport to the Delta Plant for mineral processing and off-site mineralised waste disposal.

Open-cast mining will allow for the Leiden Coal Mine to improve revenue and ramp up overall production of the mine at a quicker rate. In addition, the use of the open-cast mining method will provide quicker and easier highwall access to the underground.

<u>The use of this mining method caters for maximising commercial aspects of mine production. Open-cast mining methods are considered and assessed in the development alternatives section of this report, specifically in Alternative 2: Maximum Mine Production.</u>

4.3.2 UNDERGROUND MINING

Two underground mining sections are proposed. The proposed underground mining method to be employed will be the bord and pillar mining method. The two underground sections are to be developed on a grid basis where coal will be extracted across a horizontal plane, leaving open area or “rooms” underground, while also leaving pillars to support the overburden above and reduce the risk of subsidence.

The size of the pillars will be determined through the use of the Salamon & Munro formulae, an important factor in determining optimal pillar size to ensure the stability of the underground mine workings whilst minimising the potential for surface subsidence. The Salamon & Munro formulae assists in the determination of pillar size through considerations of depth, seam width and coal strengths as provided by the geology of the reserve. Based on the above, a Safety Facto of 1.6 has been provisionally calculated and is deemed appropriate allowing for the extraction of 62% of the mineable coal reserves from the two underground sections.

Bord width has been determined and set at 6.5 m for all underground mining areas while Panel width is to be determined by the shuttle car cable capacity. Panel lengths in excess of 500 m and up to 1000 m have been designed for the underground sections. As a result of the relatively flat seam floor, the power requirement for Trunk and Belt sections are commensurate with other underground coal mining operations in South Africa and Mpumalanga, specifically.

Access to the two underground sections will be through a box-cut of approximately 12 ha which will act as the entrance to the decline shaft. The creation of this box-cut/portal will be undertaken over a period of 18 months and will be used to gain adequate highwall access to the two underground sections. The annual estimated rate of production for the underground sections is estimated at 35 000 tonnes per month for a period of 96 months. All RoM will be transported by conveyor to the onsite mobile crusher and then stockpiled for transport to the Delta Plant where mineral processing and final mineralised waste disposal will be undertaken.

The use of this mining method caters for both mine commercial aspects and environmental considerations allowing for the generation of sufficient revenue to pay the high costs associated with accessing the underground reserves whilst considering environmental constraints such as proximity to watercourses and other sensitive environmental features.

Underground mining methods are considered and assessed in the development alternatives section of this report, specifically in Alternative 3: Sensitivity Planning Approach.

4.3.3 MINING SCHEDULE

Proposed mining operations are scheduled to commence once all necessary environmental authorisations and licenses have been granted. For both mining scenarios, site establishment and creation of the open-cast boxcut or portal/adit are expected to take place within the first 18 months of commencement.

Should open-cast mining be employed thereafter, this will take approximately 16 months during which the highwall portal to the underground sections will be established to access the underground reserves.

Should underground mining only be employed then a decline shaft will be developed from the portal or adit within 10 months and at a provisional angle of 8 degrees.

The mining schedule is presented below in Figure 45:

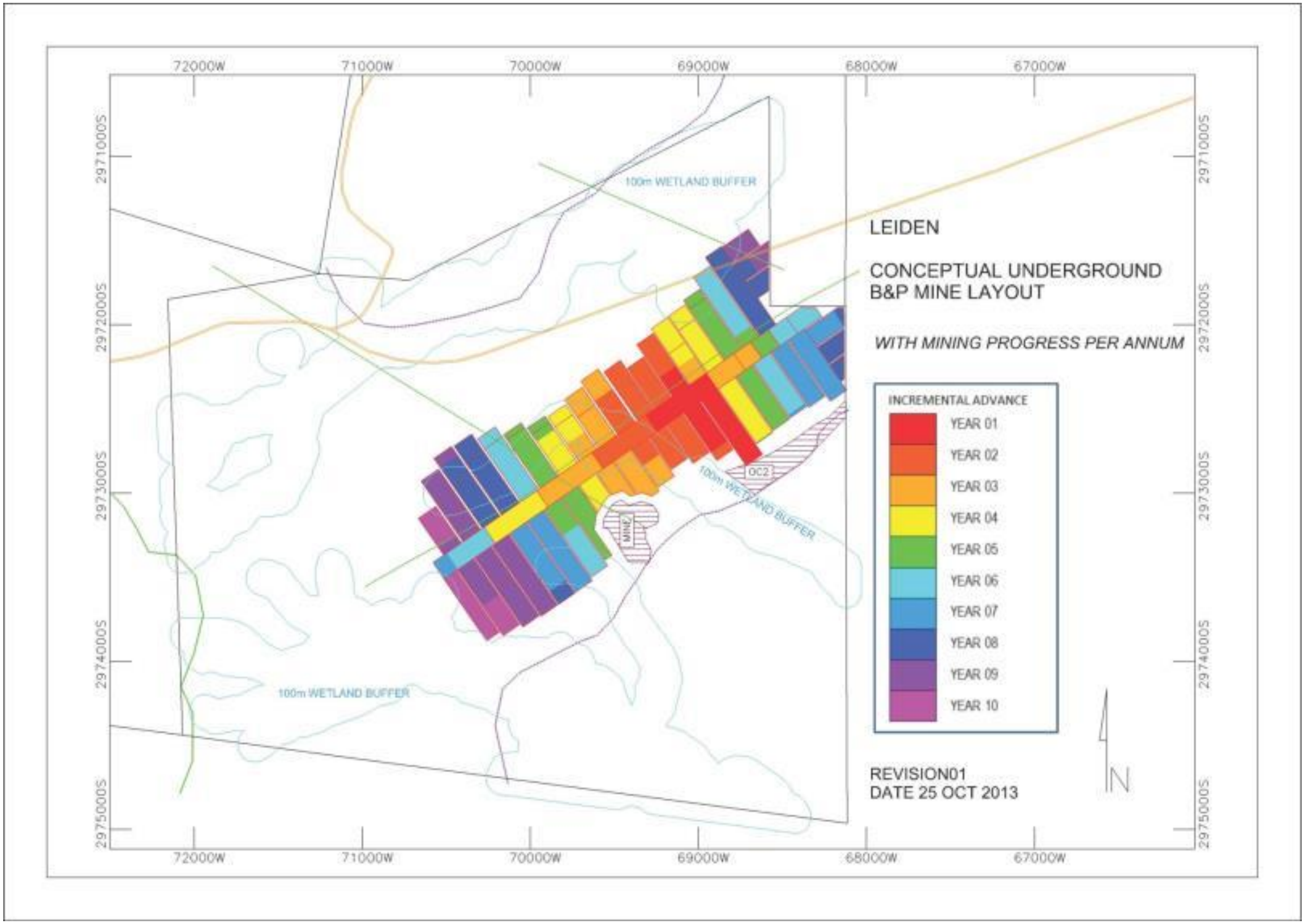


Figure 45: Mine schedule

4.4 MINERALS PROCESSING

The proposed Leiden Coal Mine will only utilise a small, mobile onsite crusher for initial minerals processing. The crusher will be used to crush and screen RoM to a manageable size prior to it being stockpiled. Crushed and stockpiled RoM will then be transported by conventional load and haul operations to the offsite Delta Plant in Ermelo for further mineral processing. Other than primary crushing and screening, no further mineral processing will take place at the project site. All further RoM processing and final mineralised waste disposal will take place at Delta Plant, includes coal discards.

4.5 STOCKPILES

4.5.1 RUN OF MINE STOCKPILES

Crushed and screened RoM will be stockpiled in designated lined areas complete or within impervious bunds near the onsite mobile crusher. The lined or bunded areas will be designed to accommodate monthly volumes of RoM stockpiles as well as contain any contaminated water that may enter the area and from slurry. Contaminated water will be disposed of in the PCD where it will form part of the water recycled between the water treatment plant and underground mine sections where it will be used for dust suppression. Coal fines will also periodically be cleaned from the PCD and also transported offsite for disposal at the Delta Plant. Finally, the RoM stockpile areas will be used for the collection of crushed coal product and coal discards for final transport to the Delta Plant for minerals processing and waste disposal.

4.5.2 NON-CARBONACEOUS STOCKPILES

Overburden stockpiles comprising of both hards and softs will be stockpiled both at the entrance to the highwall and along the boundary of the proposed surface infrastructure layout. As such, the overburden stockpiles will be used in conjunction with the proposed berms to trap and separate dirty water within the mining area and direct it to the PCD for storage and re-use.

4.5.3 TOPSOIL STOCKPILES

Stripped soils of significantly different soil groups will be stockpiled separately. This will ensure that the characteristics of soil stockpiles are suitable for the prevailing landscape and drainage conditions once they are replaced. Soil stockpiles will be separated and stored into categories based on clay content and into topsoil and subsoil horizons. All topsoil stockpiles will be placed in a topographical crest, where practical which will provide free drainage in all directions and added safety from erosion concerns. Alternative, a side-slope location with suitable cut-off berm construction upslope is acceptable. Stockpiles will also be placed in areas far removed from mining activities where they will not be accidentally impacted on or where they will need to be frequently moved.

4.6 SURFACE INFRASTRUCTURE

Due to all mineral processing and mineralised waste disposal occurring at the Delta Plant in Ermelo, the proposed Leiden Coal Mine requires limited infrastructure in order to operate. As such, the infrastructure required is listed below:

- Pollution control dam;
- Storm water/ return water dam;
- Storm water management including clean and dirty water separation systems;
- Access and haul roads;
- Pipelines;
- Conveyor belt (including coal cutters, loader, shuttle cars, roof belt and feeder bracket)
- Mobile crusher;
- RoM Stockpiles;
- Weighbridge;
- Diesel storage;
- Chemical storage;
- Explosive magazine;
- Mobile offices;
- Mobile ablution block;
- Mobile workshops and stores;
- Modular sewage treatment plant & prefabricated water purification plant;
- Temporary general waste storage area;
- One (1) decline shaft; and
- One (1) ventilation shaft.

The surface infrastructure to be utilised by the mine is mostly prefabricated and easily portable. Where relevant, further information related surface infrastructure requirements is provided in detail below.

4.6.1 ADMINISTRATION BUILDINGS, ENGINEERING BAYS, WORKSHOPS AND OTHER BUILDINGS

As the proposed Leiden Coal Mine will be supported by the existing Delta Plant limited infrastructure such as administration buildings, engineering bays and workshops are required. A mobile office block and ablution facility will be located within the Leiden operations area. The mobile office block and ablutions facility are temporary modified container structures that will house the site offices as well as an ablution block for employees. The mobile office block will serve as the base of operations for coordinating the mining operation and the ablution block will serve as a change room and ablution facility for employees.

4.6.2 HAZARDOUS GOODS STORAGE

The proposed Leiden Coal Mine will require infrastructure for the storage and handling of hydrocarbons, chemical and explosives. All hazardous storage facilities will be above ground, bunded facilities with a combined capacity of more than 500 m^3. All hazardous goods will be used during actual mining operations for the re-fuelling of diesel powered equipment onsite. The relevant Health and Safety Standards for the handling and storage of these goods will be strictly adhered to.

4.6.3 MODULAR MINE WATER TREATMENT PLANT

A packaged treatment plant will be constructed and operated at the entrance to the underground. Raw water from the underground working and PCD will be pumped to the treatment plant where through the first stage of the Reverse Osmosis (RO) unit water will be treated predominantly for industrial use and re-used for mining activities including dust suppression. Approximately 20% of the water will then be pumped to the second stage of the RO unit where it will be treated to potable standards and used for drinking water purposes.

4.6.4 MODULAR SEWERAGE TREATMENT PLANT

A packaged sewerage treatment plant will be constructed to manage and treat sewerage with an annual capacity of less than 15 000 m^3. Sewerage generated from the mobile offices, ablution facility and workshops will be treated for predominantly industrial use and re-used for mining activities underground. Approximately 20% of the water will then be pumped to a RO unit where it will be treated to potable standards and used for drinking water purposes.

4.6.5 OIL AND WATER SEPERATOR

Two 600 litre oil and water separators will be constructed and utilised at the mine to separate all hydrocarbons from water through segregation from emulsion. The first will be constructed at the entrance to the underground and the second will be part of a packaged washbay complete with an effluent separation unit. A second effluent separation unit will be located at the front end of the RO plant.

4.6.6 WASHBAY

A washbay utilising two high pressure washer per bay and complete with effluent separation, silt trap as well as an oil and water separation system will be constructed. All effluent will be collected in a sediment trap and effluent separation system to allow for the efficient collection of fines and solids as well as hydrocarbon separation.

4.6.7 WEIGH BRIDGE

A single weigh bridge will be constructed near the RoM stockpile to track and record weights for final products originating from the Leiden Coal Mine and sent for processing at the Delta Plant.

4.6.8 SITE ACCESS AND CONTROL

Access to the mine will controlled through a single entrance and exit point onto the mining area. 1.8 m high razor diamond-mesh fencing will be utilised to ring fence the operational area including water dams. Strict access control will be employed to optimise control over the flow of contractors and mine personnel to the operations area. All visitors to the operations area will be required to sign in at the security checkpoint located and the entrance gate and are required to complete the induction before access. A third party security company shall be utilised to ensure site access control.

4.7 WASTE

Domestic, hazardous, industrial and mining and sewerage waste streams will be generated at the proposed Leiden Coal Mine.

4.7.1 DOMESTIC WASTE STREAMS

Domestic waste generated will be collected and stored onsite in clearly marked skips. All domestic waste skips will be transported offsite by a registered waste removal contractor for final disposal at a registered facility. Waste disposal certificates will be required from contractors to ensure appropriate waste disposal.

4.7.2 HAZARDOUS WASTE STREAMS

Hydrocarbon and other dangerous good contaminated wastes generated (including used oil, diesel, grease, lubricants and explosive emulsions) will be stored in clearly marked skips for solid waste and containers for liquid waste. Hazardous waste will be stored in bunded areas or on hard, impervious surfaces. When full the containers will be collected and transported offsite by a registered waste removal contractor for final disposal at a registered facility. Waste disposal certificates will be required from contractors to ensure appropriate waste disposal.

4.7.3 INDUSTRIAL AND MINING WASTE STREAMS

Industrial wastes (including metals, rubber, tyres and conveyor belt sheets) will be separated and stored in clearly marked skips. Materials may occasionally be salvaged for re-use but will generally be traded to registered recycling companies who will collect and transport material offsite for re-use or final disposal at a registered facility. Waste disposal certificates will be required from contractors to ensure appropriate waste disposal.

Two general forms of mineralised waste will be generated at the proposed Leiden Coal Mine namely discards and coal falling of trucks from the RoM stockpile and fines. Coal falling from trucks and discards will be periodically collected and transported offsite to the Delta Plant. Fines will be channelled to the PCD where water will be recycled and the fines periodically cleared and also transported offsite to the Delta Plant for final disposal.

4.7.4 SEWERAGE WASTE STREAMS

Sewerage waste generated will be managed by the package sewerage treatment plant to be constructed. The plant requires the construction of a number of rectangular concrete tanks and a conically shaped concrete digester with interconnecting pipework. These will be constructed in-situ using conventional reinforced concrete construction. Treated waste water will be fed back into the mine water system for re-use in the underground. The sewage treatment plant will be sized to cater for a percentage of the total potable water demands for the operation. The treated sewage water will be piped from the sewage treatment plant to (and stored in) an industrial water reservoir in order to reduce make up water requirements. Portable toilets will be used during the construction phase and the raw sewage will be disposed of at the dedicated sewerage plant or alternatively be collected by a licensed contractor for disposal at a licensed sewage treatment plant.

4.8 WATER SUPPLY

The proposed Leiden Coal Mine will require water in the form of both potable and bulk water for the mining process.

4.8.1 POTABLE WATER SUPPLY

Potable water will be obtained from water treated at the package plants after further treatment via RO. Potable water requirements will make up approximately 20% of the water treated at a continuous rate of 2.5 m^3/hour. As such, potable water will be made available for the required 120 people on site at a rate of 50 litres per day.

4.8.2 PROCESS WATER SUPPLY

The proposed Leiden Coal Mine requires a relatively small water demand of 100 litres per tonne mined. The majority of process water will be required for underground mining purposes in the form of dust suppression on the conveyor transfer points as well as coalcutter and loader operations. In addition, process water will be further used for surface dust suppression and washbay consumption. Based on the water balance 180 m^3 per day of water is required for dust suppression and a further 5m^3 per day for the washbay.

4.9 CLEAN AND DIRTY WATER PROCESSES

Management of clean and dirty water systems is required for effective pollution control. Pollution control will be maximised through facilitating the following:

- Control run-off and seepage entering the mining area;
- Control run-off emanating from stockpiles; and
- Control and separate the mixing of clean water and polluted water which is contained in the pollution control dam (PCD) and storm water/return water dam

Clean and dirty areas were determined and mapped out based on topography of the planned mine surface infrastructure. The entire mining area was demarcated as a dirty area and the area to the north is demarcated as clean water. The area calculated for the clean catchment is 0.52 km^2 and the area calculated for the dirty catchment is 0.19 km^2.

The location of the proposed berm is included in the mine layout to contain dirty water within the mine area and direct it to the storm water/return water dam. Drain D1 is recommended to be placed outside of the berm to prevent ponding of clean water and direct it away from the mine area. The storm water/return water dam is to be located near the entrance of the mining area as this location is the lowest topographical point within the mining area. All dirty water infrastructure will be lined and designed to accommodate a 1:50 year flood event. The proposed infrastructure is indicated in Figure 46 below.

Figure 46: Proposed infrastructure

4.9.1 CLEAN AND DIRTY WATER SYSTEMS

The collection of dirty water and diversion of clean water will be achieved through the use of earthen channels and berms. These systems will be designed so that clean water is effectively diverted from dirty water and allowed to pass through to other downstream users. Figure 47 below indicates a cross section of the proposed channel to be constructed.

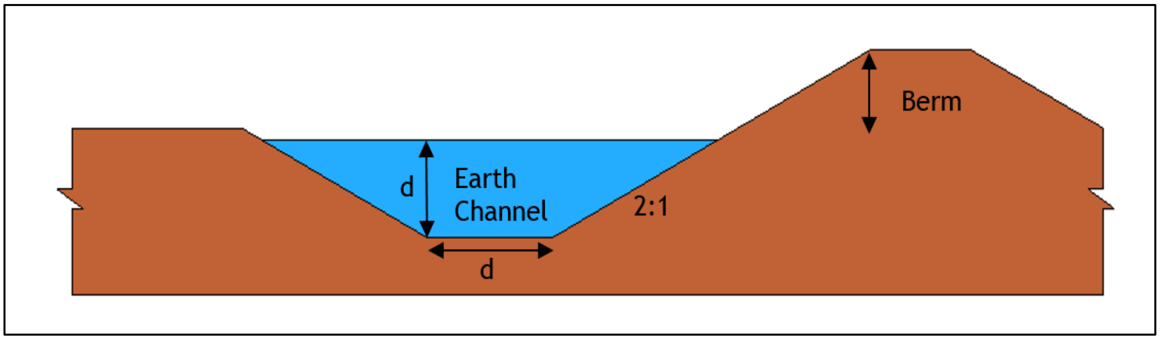


Figure 47: Cross section of earthen channel

As the clean water from the area is expected to be carrying sediments, the channel for clean water diversion will include a gravel bed. Further channel dimensions have been calculated and are provided below in Table 19. It is strongly recommended that all channels be constructed using these dimensions.

Table 19: Channel design parameters

Parameter	Channel D1
Shape	Trapezoidal
Base width	1.66 m
Side slopes	2:1 (V:H)
Flow depth	1.66 m
Channel depth (+Freeboard)	0.8 m
Max flow velocity	1.66 m/s

An HDPE lined PCD and storm water/return water dam will be constructed and located within the Leiden Coal Mine operations area. Both dams will have a height not exceeding 10 m and a combined capacity of 53 000 m^3. The purpose of the dams are to collect water diverted by the clean and dirty water separation system where it can be treated and re-used for mining activities.

In addition, water from the underground working will also be pumped via pipe to the PCD. Both dams will be maintained and operated so as to not spill any dirty water into a clean water system more than once in 50 years and a minimum freeboard of 0.8 m above the fully supply level will be maintained.

4.9.2 STORMWATER MANAGEMENT PLAN

The storm water management plan is indicated in Figure 48 below:

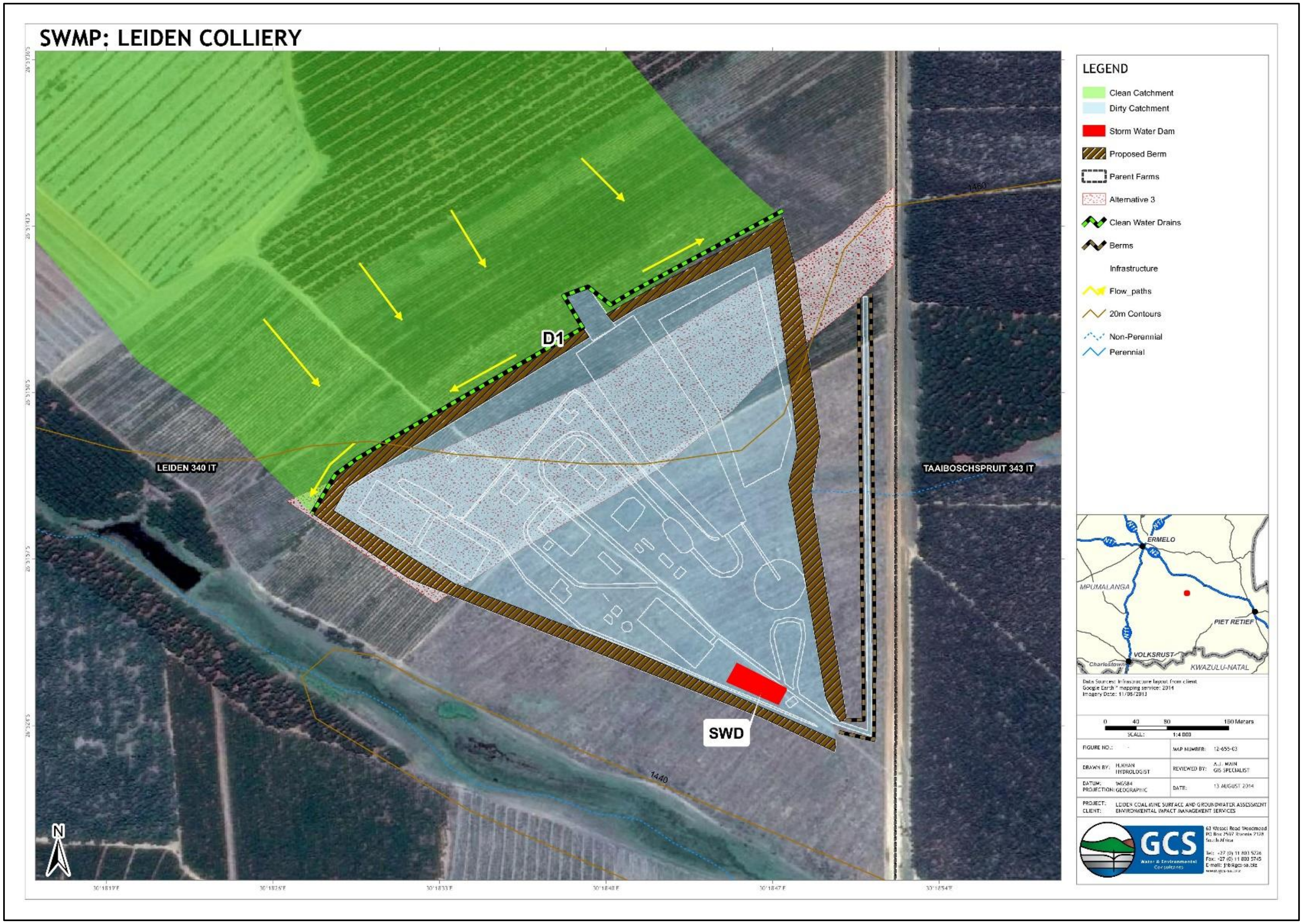


Figure 48: Conceptual SWMP for the Mine Layout

The storm water management developed for the proposed Leiden Coal Mine includes consideration of the 1:50 and 1:100 year flood lines for each catchment in order to accommodate the volume of water in the design of drains, berms, PCD and storm water/return water dam. Drain D1 will be built to accommodate a clean water area flood peak of 29.03 m^3 /s. This will ensure that the drain will not overflow more than once every 50 years. The berms and drains built in the dirty water catchment will also be designed to accommodate a flood peak of 16. 98 m^3.

4.9.3 POLLUTION CONTROL DAM

An HDPE lined PCD will be constructed and located within the Leiden Coal Mine operations area. The dam will have a height not exceeding 10 m and a combined capacity of 53 000 m^3 (In conjunction with the storm water/return water dam). The purpose of the dams are to collect water diverted by the clean and dirty water separation system where it can be treated and re-used for mining activities. In addition, water from the underground working will also be pumped via pipe to the PCD. The dam will be maintained and operated so as to not spill any dirty water into a clean water system more than once in 50 years and a minimum freeboard of 0.8 m above the fully supply level will be maintained.

4.9.4 STORM WATER/RETURN WATER DAM

An HDPE lined storm water/return water dam will be constructed and located within the Leiden Coal Mine operations area. The dam will have a height not exceeding 10 m and a combined storage capacity of 53 000 m^3 (in conjunction with the PCD). The purpose of the dam are to collect water diverted by the clean and dirty water separation system where it can be treated and re-used for mining activities. The dams will be maintained and operated so as to not spill any dirty water into a clean water system more than once in 50 years and a minimum freeboard of 0.8 m above the fully supply level will be maintained. The dam will be placed near the entrance of the mining area as this is the lowest point of the mine.

4.9.5 WATER AND SALT BALANCE

The water balance for the proposed Leiden Coal Mine was calculated for three different scenarios namely, the driest month in the year, the wettest moth and the average annual water balance. The results of the water balance are provided below in Figure 49, Figure 50, Figure 51, and Figure 52. All water balances calculated produced excess water due to groundwater ingress volumes of 742 m^3 /day in comparison to relatively small water demand of the mine. As such it can be expected that there will be an excess of 221 125 m^3 / average year. As a result of the excess water balance, the following should be considered:

- Conduct water treatment to release/discharge water of acceptable quality back into the receiving environment;

- Drill boreholes away from site so water can be pumped out of ground water and into nearby stream or watercourses. This will in turn drop the ground water table and reduce the amount of ground water ingress into the underground mine workings;
- Implement evaporation pans and evaporation canons; and
- Implement alternative water uses such as controlled irrigation of plantations. Care must be taken and use controlled owing to the build-up of salts or other contaminants in the water.

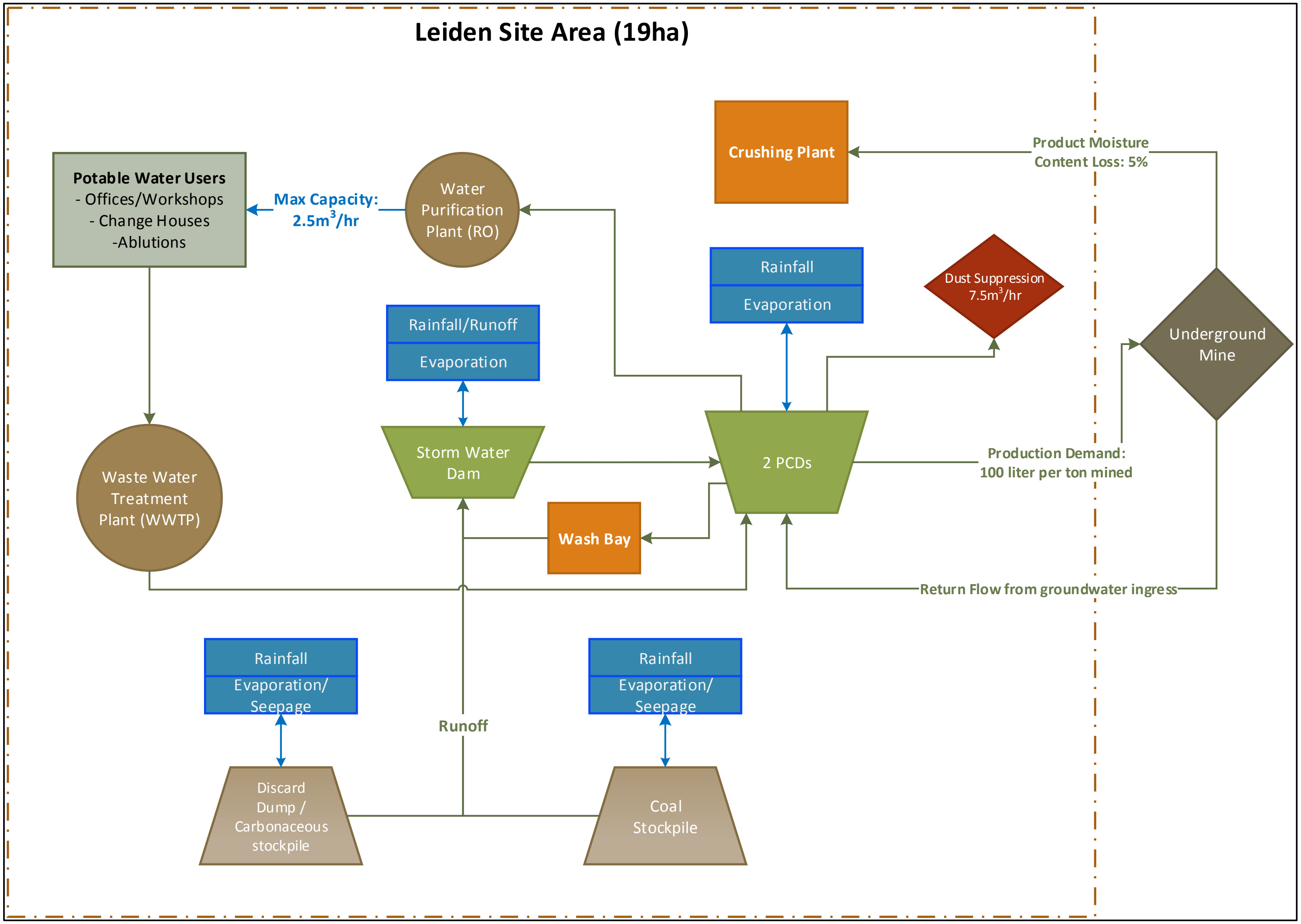


Figure 49: Process flow diagram for the Leiden Coal Mine

LEIDEN COLLIERY				
WATER BALANCE FOR AN AVERAGE YEAR (m3/year)				
IN			OUT	
Groundwater ingress	270 901 m3/year	Underground Mine	PCD	311 965 m3/year
PCD	41 064 m3/year			
Product Moisture Content	41 064 m3/year	Crushing Plant	Product Moisture Loss	41 064 m3/year
Rainfall	5 737 m3/year	PCD (2x)	Evaporation	9 728 m3/year
Storm Water Dam	39 625 m3/year		Underground Mine	41 064 m3/year
Underground Mine	311 965 m3/year		Dust Suppression	65 700 m3/year
WWTP	2 190 m3/year		Water Purification Plant (RO)	21 900 m3/year
			Excess	221 125 **m3/year**
Rainfall	12 384 m3/year	Storm Water Dam	Evaporation	21 000 m3/year
Runoff Site Area	48 241 m3/year		PCD	39 625 m3/year
Rainfall	18 336 m3/year	Discard Dump / Carbonaceous stockpile	Seepage	3 369 m3/year
			Storm Water Dam	5 639 m3/year
			Evaporation	9 328 m3/year
Rainfall	2 410 m3/year	Coal Stockpile	Seepage	443 m3/year
			Storm Water Dam	741 m3/year
			Evaporation	1 226 m3/year
Potable Water Users	2 190 m3/year	Waste Water Treatment Plant (WWTP)	PCD	2 190 m3/year
PCD	21 900 m3/year	Water Purification Plant (RO)	Potable Water Users	2 190 m3/year
			Discharge	19 710 m3/year
Water Purification Plant (RO)	2 190 m3/year	Potable Water Users - Offices/Workshops - Change Houses -Ablutions	WWTP	2 190 m3/year
TOTAL	**820 198 m3/year**	**<- Check Balance - >**	**TOTAL**	**820 198 m3/year**

Figure 50: Annual Water Balance

LEIDEN COLLIERY				
WATER BALANCE FOR A DRY MONTH (m3/month)				
IN			OUT	
Groundwater ingress	23 008 m3/mon	Underground Mine	PCD	25 061 m3/mon
PCD	2 053 m3/mon			
Product Moisture Content	3 422 m3/mon	Crushing Plant	Product Moisture Loss	3 422 m3/mon
Rainfall	72 m3/mon	PCD (2x)	Evaporation	481 m3/mon
Storm Water Dam	0 m3/mon		Underground Mine	2 053 m3/mon
Underground Mine	25 061 m3/mon		Dust Suppression	5 580 m3/mon
WWTP	186 m3/mon		Water Purification Plant (RO)	1 825 m3/mon
			Excess	15 381 **m3/mon**
Rainfall	156 m3/mon	Storm Water Dam	Evaporation	768 m3/mon
Runoff Site Area	612 m3/mon		PCD	0 m3/mon
Rainfall	230 m3/mon	Discard Dump / Carbonaceous stockpile	Seepage	0 m3/mon
			Storm Water Dam	220 m3/mon
			Evaporation	10 m3/mon
Rainfall	30 m3/mon	Coal Stockpile	Seepage	0 m3/mon
			Storm Water Dam	20 m3/mon
			Evaporation	10 m3/mon
Potable Water Users	186 m3/mon	Waste Water Treatment Plant (WWTP)	PCD	186 m3/mon
PCD	1 825 m3/mon	Water Purification Plant (RO)	Potable Water Users	186 m3/mon
			Discharge	1 639 m3/mon
Water Purification Plant (RO)	186 m3/mon	Potable Water Users - Offices/Workshops - Change Houses -Ablutions	WWTP	186 m3/mon
TOTAL	**57 028 m3/mon**	**<- Check Balance - >**	**TOTAL**	**57 028 m3/mon**

Figure 51: Water Balance for an Average Dry Month

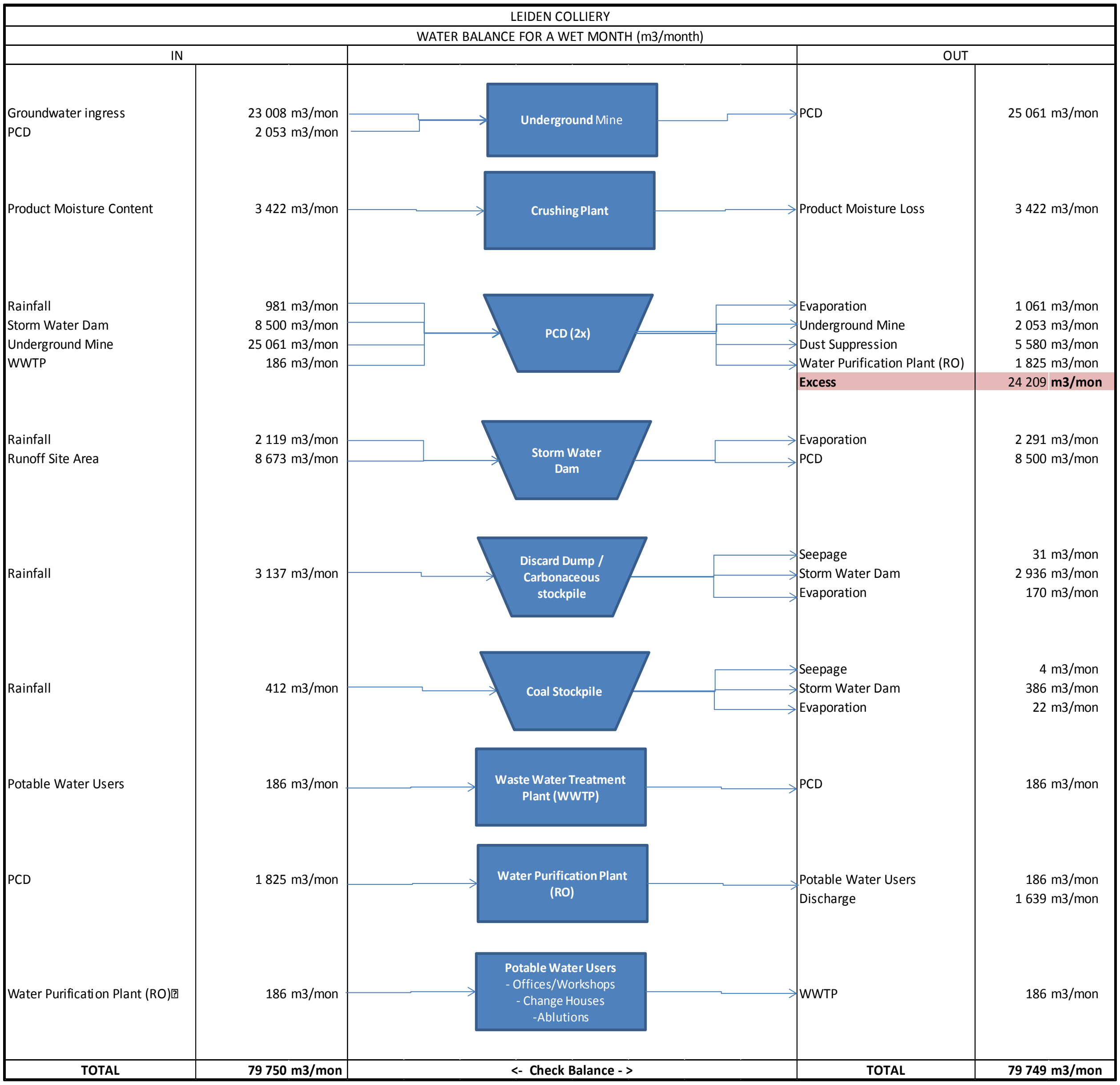


Figure 52: Water Balance for an Average Wet Month

4.10 BULK POWER SUPPLY

Diesel generators will be utilised for power during the construction phase of the mine. Eskom generated electricity in the form of a substation generating <3Mva will be required for the underground operations in the operational phase. It is anticipated that electricity will be obtained from the existing electrical distribution network in the area. The connection point, substation and routes will be determined after further investigations are undertaken and concluded

4.11 LOGISTICS

Access to the Leiden Coal Mine will be via the N2 which links to Ermelo and the Delta Plant. Two access routes to the proposed mines from the N2 have been assessed namely Gravel Road 1 and Gravel Road 2. As a result of the Traffic Impact Assessment undertaken, Gravel Road 2 is the preferred mining access and haul road.

Gravel Road 2 is ± 18 km long and is surfaced from the N2 for ±1,5km after the N2 / Gravel Road 2 intersection after which the gravel road starts. Gravel Road 2 travels in an east-western direction. The road is much flatter and does not traverse any river crossings. In addition Gravel Road 2 is better suited for hauling operations as it has already been designed to accommodate timber haul trucks. Re-surfacing of some sections of the road will be required. The route that Gravel Road 2 will follow is indicated in Figure 53 below.

Figure 53: Access routes

4.12 LIST OF MAIN MINING ACTIONS, ACTIVITIES AND PROCESSES OCCURRING ON SITE

The main mining actions, activities and process that are planned to take place on site are listed in the table below. All actions, activities and processes have been grouped into each of the relevant project phases namely: pre-construction, construction, operation, decommissioning, rehabilitation and closure. For the purpose of this report, the following broad definitions apply:

- Pre-construction refers to the phase in which planning takes place;
- Construction refers to the phase in which the site is prepared and infrastructure is established;
- Operation refers to the phase in which physical mining and production takes place;
- Decommissioning refers to the phase in which infrastructure is removed and rehabilitation efforts are applied and their success monitored; and
- Closure refers to the phase in which maintenance and rehabilitation monitoring are undertaken to ensure that the mines closure objectives are met.

Table 20: List of main action, activities or processes on site and per phase

Main Activity/Action/Process	Ancillary Activity	Pre-Construction	Construction	Operation	Decommissioning	Closure
Site preparation	Vegetation clearance		As required	As required	As required	
	Removal of infrastructure		As required	As required	As required	
	Planned placement of infrastructure		At start of phase	As required		
	Establishment of construction contractor area		At start of phase	As required		
Human resources management	Employment/recruitment		At start of phase	As required	As required	As required
	I&AP consultations		At start of phase	On-going	On-going	On-going
	CSI initiatives		At start of phase	On-going	On-going	On-going
	Skills development programmes	At start of phase	On-going	On-going	On-going	On-going
	Environmental awareness training		At start of phase	On-going	On-going	As required
	HIV/AIDS Awareness programmes		At start of phase	On-going	On-going	
	Integration with Municipalities' strategic long term planning	At start of phase	On-going	On-going	On-going	
Earthworks	Stripping and stockpiling of soils		At start of phase	As required	As required	
	Cleaning, grubbing and bulldozing		At start of phase	As required	As required	
	Removal of building waste and cleared vegetation		At start of phase	As required		
	Digging trenches and foundations		At start of phase	As required	As required	
	Blasting		As required	As required	As required	
	Establishment of external haul roads		At start of phase			
	Establishing stormwater management measures		At start of phase	As required	As required	
	Establishment of firebreak		At start of phase	As required	As required	

Main Activity/Action/Process	Ancillary Activity	Pre-Construction	Construction	Operation	Decommissioning	Closure
Civil Works	Establishment of infrastructure and services		At start of phase	As required		
	Mixing of concrete and concrete works		As required	As required		
	Establishment of PCD and storm water/return water dam		At start of phase	As required	On-going	
	Establishment of dewatering pipelines		At start of phase	As required		
	Establishment of mobile office and ablution block		At start of phase	As required	As required	
	Sewage and sanitation		At start of phase	On-going	On-going	
	Establishment of fuel storage area		At start of phase			
	Establishment of chemical storage area		At start of phase			
	Establishment of explosives storage area		At start of phase			
	Establishment of general waste area		At start of phase			
	Access control and security		At start of phase	As required	As required	
	General site management		On-going	On-going	On-going	On-going
Open-cast and Underground Mining	Drilling		As required	As required		
	Blasting		As required	As required		
	Excavations		As required	As required		
	Removal of overburden by dozing and load haul			As required		
	Establishment of internal haul roads			As required	As required	
	Removal of ore			On-going		
	Establishment of RoM stockpiles			As required	As required	
	RoM stockpile transport to Delta			On-going	On-going	

Main Activity/Action/Process	Ancillary Activity	Pre-Construction	Construction	Operation	Decommissioning	Closure
	De-watering of underground workings			On-going	On-going	
	Pumping of water to PCD			On-going	On-going	
	Waste rock dumps for backfilling			On-going	On-going	
	Soil management		On-going	On-going	On-going	On-going
	Water management		On-going	On-going	On-going	On-going
	Concurrent rehabilitation			On-going	On-going	On-going
	Water treatment			On-going	On-going	On-going
Infrastructure removal	Dismantling and demolition of infrastructure				As required	
	Blasting				As required	
	Safety control				On-going	On-going
Rehabilitation	Backfilling of pits and voids			On-going	On-going	
	Slope stabilisation			On-going	On-going	On-going
	Erosion control			On-going	On-going	On-going
	Landscaping			On-going	On-going	On-going
	Replacing topsoil			On-going	On-going	On-going
	Removal of alien/invasive vegetation			On-going	On-going	On-going
	Re-vegetation			On-going	On-going	On-going
	Restoration of natural drainage patterns				On-going	On-going
	Remediation of ground and surface water			On-going	On-going	On-going
	Rehabilitation of external roads				On-going	On-going
Maintenance	Initiate maintenance and aftercare program				At end of phase	On-going
	Environmental aspect monitoring			On-going	On-going	On-going
	Monitoring of rehabilitation					On-going

4.13 LIST OF ACTIVITIES IN TERMS OF NEMA EIA REGULATIONS

Table 21: Listed activities in terms of the NEMA Regulations

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
Activities for Basic Assessment:			
GNR 544 of 18 June 2010	Activity 9	The construction of pipelines exceeding 1 000 m in length for the abstraction of water and transport of water/sewage.	Pipelines for water abstraction and water/sewage transport
GNR 544 of 18 June 2010	Activity 10	The construction of a substation for the transmission and distribution of electricity outside of an urban area.	Construction of Eskom substation
GNR 544 of 18 June 2010	Activity 11	The construction of canals, channels, dams, bulk stormwater outlets, and administrative infrastructure to be constructed within 32 m of a watercourse	Construction of storm water management measures, a PCD, bridges/watercourse crossings, temporary ablution block and temporary placement of office block/containers within 32 m of a water course
GNR 544 of 18 June 2010	Activity 12	The construction of infrastructure for the off-stream storage of water with a combined capacity of 50 000 cubic m	Water storage in PCD and associated dams
GNR 544 of 18 June 2010	Activity 13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres	Diesel, chemical and explosive storage and handling
GNR 544 of 18 June 2010	Activity 18	Infilling or deposition of any material of more than 5 cubic m into a watercourse.	Infilling/deposition during upgrade/expansion of bridges/river crossings.

Indicate the number and date of the relevant notice:	**Activity No (s) (in terms of the relevant or notice) :**	**Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):**	**Triggered by:**
GNR 544 of 18 June 2010	Activity 22	The construction of a road outside of urban areas: (i) with a reserve wider than 13,5 m (ii) where no reserve exists where the road is wider than 8 m	Internal haul roads and external roads to off-site mineral processing complex.
GNR 544 of 18 June 2010	Activity 26	Any process of activity identified in terms of Section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)	Operating in a threatened/protected eco-system if applicable
GNR 544 of 18 June 2010	Activity 39	The expansion of canals, channels, and bridges within a watercourse or within 32 m of a watercourse.	Expansion or upgrading of existing watercourse crossings or bridges
GNR 544 of 18 June 2010	Activity 47	The widening of a road by more than 6 m or the lengthening of a road by more than 1 km: (i) where the existing reserve is wider than 13,5 m (ii) Where no road reserve exists, where the existing road is wider than 8 m	Upgrades to existing roads for transport of RoM to off-site minerals processing complex
GNR 544 of 18 June 2010	Activity 55A	The construction of facilities for the treatment of effluent, wastewater or sewage with an annual throughput capacity of more than 2 000 cubic m but less than 15 000 cubic m.	The construction of a temporary modular waste water and sewage treatment facility to be used by the mine to treat waste water, sewage, and effluent.
<u>Activities for Scoping, EIA and EMP:</u>			
GNR 545 of 18 June 2010	Activity 3	The construction of facilities/infrastructure for the storage and handling of dangerous goods with a combined capacity of more than 500 cubic m.	The construction of diesel storage facilities for use by mine equipment and vehicles and the construction of

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
			facilities for explosives and chemical storage for use during mine construction and operation. The combined storage capacity of the facilities (diesel, explosives and chemicals) will be more than 500 cubic m.
GNR 545 of 18 June 2010	Activity 10	Construction of facilities/infrastructure for the transfer of 50 000 cubic m or more per day to a water treatment plant and PCD.	Water treatment plant and PCD.
GNR 545 of 18 June 2010	Activity 19	The construction of a dam where the highest part of the wall is 5 m or higher or where the high water mark of the dam covers an area of 10 hectares or more.	Construction of PCD and associated dams.
GNR 545 of 18 June 2010	Activity 20	Any activity which requires a mining right or renewal thereof as contemplated in Section 22 and 24 respectively of the MPRDA (Act. No. 28 of 2002).	Mining Right Application.
GNR 545 of 18 June 2010	Activity 27	The construction of facilities for the treatment of effluent, waste water, or sewage with an annual throughput capacity of 15 000 cubic m or more.	The construction of waste water/temporary modular sewage treatment facilities.
<u>Provincial Specific Activities:</u>			
GNR 546 of 18 June 2010	Activity 4	Construction of roads wider than 4 m with a reserve less than 13.5 m in a: (ii)(aa) protected areas identified in terms of NEMPAA (ii)(bb) national protected expansion strategy (ii)(cc) sensitive area identified in an EMF.	Eastern Valley Grassland, Wakkerstroom Luneburg Grassland, and possibly MTPA CBA or expansion areas.

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
GNR 546 of 18 June 2010	Activity 5	The construction of facilities and infrastructure such as PCD's and storm water infrastructure which requires a permit or license in terms of national or provincial legislation governing the release of emissions, pollution or effluent not identified in GNR 544.	Facilities or infrastructure requiring a WUL such as PCD's and storm water infrastructure.
GNR 546 of 18 June 2010	Activity 10	Construction of facilities/infrastructure for storage/handling of dangerous goods with a combined capacity of 30 but not exceeding 80 cubic m in: (ii)(aa) protected areas identified in terms of NEMPAA (ii)(bb) national protected expansion strategy (ii)(cc) sensitive area identified in an EMF.	Storage in Eastern Valley Grassland, Wakkerstroom Luneburg Grassland and possibly MTPA CBA or expansion areas.
GNR 546 of 18 June 2010	Activity 12	The clearance of an area of 300 square metres of more where 75% constitutes indigenous vegetation within a critically endangered or endangered eco-system listed in terms of Section 52 of the NEMBA	Clearance of Eastern Valley and Wakkerstroom Luneburg grassland
GNR 546 of 18 June 2010	Activity 13	Clearance of an area of 1 hectare or more of vegetation where 75% or more constitutes indigenous cover within: (a) Any critically endangered or endangered ecosystem; or (b) Within critical biodiversity areas identified in bioregional plans	Clearance of Eastern Valley and Wakkerstroom Luneburg grassland
GNR 546 of 18 June 2010	Activity 14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative covers constitutes indigenous vegetation in all areas outside of urban area.	Clearance of Eastern Valley and Wakkerstroom Luneburg grassland
GNR 546 of 18 June 2010	Activity 16	The construction of : (iii) Buildings with a footprint exceeding 10 square metres in size or (iv) Infrastructure covering 10 square metres or more	Construction of potential supporting mining infrastructure such as container offices,

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
		Where such construction occurs within 32 m of a watercourse in any critically endangered or endangered ecosystem or within a critical biodiversity area.	pipelines, and Pollution Control Dams within 32 m of a watercourse and within NEMBA listed ecosystems, namely Eastern Valley grassland and Wakkerstroom Luneburg grassland.
GNR 546 of 18 June 2010	Activity 19	Widening of roads by more than 4 m or lengthening by more than 1 km outside urban areas in any critically endangered or endangered ecosystem or within a critical biodiversity area.	Widening and lengthening of roads in Eastern Valley and Wakkerstroom Luneburg Grassland.
Activities for Waste Management Licence (WML) for Scoping, EIA, and EMP			
Category B of July 2009	Activity 1	Storage of hazardous waste: (1) Storage including temporary storage of hazardous waste in lagoons.	A PCD and waste water/temporary modular sewage treatment plant.
Category B of July 2009	Activity 4	Treatment of waste: (4) Treatment of hazardous waste using any form of treatment regardless of size or capacity of such facility to treat such waste.	Water treatment plant and temporary ablution facilities.
Category B of July 2009	Activity 5	Treatment of waste: (5) Treatment of hazardous waste in lagoons.	Water treatment plant and oil separators.
Category B of July 2009	Activity 10	Construction of facilities and associated infrastructure: (10) For activities listed in Category B of the Schedule.	The construction of PCD's and water treatment plant.
Activities for Waste Management Licence (WML) for Norms and Standards for Storage of Waste			
Category C of	Activity 1	The storage, including temporary storage	General waste

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
November 2013		of general waste at a facility that can store in excess of 100 cubic m of waste at one time, excluding waste stored in a lagoon.	storage facility.
Category C of November 2013	Activity 2	The storage of hazardous waste at a facility that has the capacity to store in excess of 80 cubic m of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons or temporary storage of such waste.	Storage of hazardous waste in a PCD.

4.14 PLANS SHOWING THE LOCATION AND AERIAL EXTENT OF PROPOSED OPERATIONS

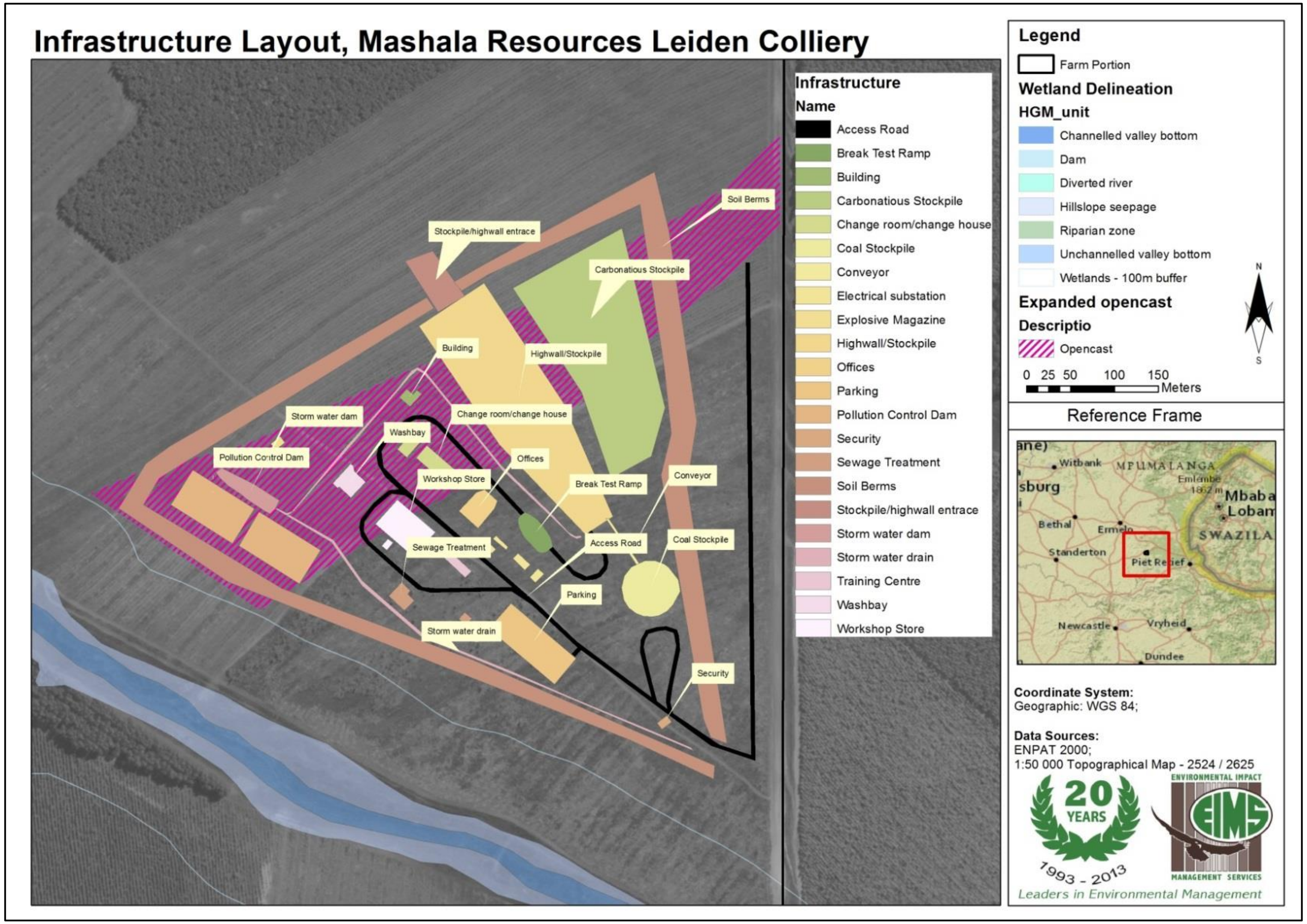


Figure 54: Location and aerial extent of proposed operations

5 POTENTIAL IMPACTS OF THE MINING OPERATIONS

5.1 LIST OF POTENTIAL IMPACTS ON ENVIRONMENTAL ASPECTS

The identification of potential impacts for further assessment was undertaken through I&AP consultation, specialist in put and the development of an in depth understanding of the activities, actions and processes to be undertaken on site by the EAP. As such, the potential impacts on broad environmental aspects, in respect of each of the main project actions, activities and processes are provided below in tabular form.

Main Activity/Action/Process	Phase	Potential Impacts related to environmental aspects
Site preparation	Construction Operation Decommissioning	Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands
		Nuisance dust
		Increase in particulate matter
		Nuisance noise from construction activities
		Noise disturbance from vehicle movement
		Noise disturbance from operations
		Visual impact of site clearance
		Visual impact of lighting
		Disturbance, damage and destruction of heritage features
Human resource	Pre-construction Construction Operation Decommissioning Closure	Loss of current land uses through bio-physical impacts
		Blasting hazards
		Damage to infrastructure rom vibration
		Safety concerns from fly rock
		Vibration nuisance
		Noise nuisance from mine employees
		Dust nuisance
		Relocation and resettlement
		Damage of roads due to project related road use
		Traffic congestion
		Influx of workers
		Employment opportunities
		Transmission of diseases
		Skills development
		Economic impacts (positive and negative)
Earthworks	Construction Operation Decommissioning	Loss of soil resource
		Loss of land capability
		Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands
		Surface water pollution
		Alteration of natural drainage patterns
		Ground water pollution/contamination
		Dust pollution
		Increase in particulate matter
		Noise nuisance from mining activities
		Visual impact of lighting
		Visual impact of earthworks

Main Activity/Action/Process	Phase	Potential Impacts related to environmental aspects
		Disturbance, damage and destruction of heritage features
Civil works	Construction Operation Decommissioning	Loss and sterilisation of mineral resources
		Loss of soil resource
		Loss of land capability
		Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands
		Surface water pollution
		Alteration of natural drainage patterns
		Ground water pollution/contamination
		Dust pollution
		Increase in particulate matter
		Noise nuisance from civil works
		Visual impact of lighting
		Visual impact of civil works
		Disturbance, damage and destruction of heritage features
Underground mining	Construction Operation Decommissioning	Loss and sterilisation of mineral resources
		Loss of soil resource
		Loss of land capability
		Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands
		Surface water pollution
		Alteration of natural drainage patterns
		Ground water pollution/contamination
		Dewatering of underground aquifers
		Dewatering of wetlands
		Dust pollution from coal movement
		Nuisance noise from blasting
		Noise pollution from movement of coal
		Visual impact of lighting
		Blasting hazards
		Damage to infrastructure rom vibration
		Safety concerns from fly rock
		Vibration nuisance
		Loss of current land uses
		Disturbance, damage and destruction of heritage features
Infrastructure removal	Pre-construction Construction Operation Decommissioning	Loss of soil resource
		Disturbance, damage and destruction of biodiversity
		Surface water pollution
		Alteration of natural drainage patterns
		Ground water pollution/contamination
		Dust pollution
		Increase in particulate matter
		Noise pollution from vehicle movement
		Blasting hazards
		Damage to infrastructure rom vibration
		Safety concerns from fly rock
		Vibration nuisance
		Visual impact of infrastructure removal
		Disturbance, damage and destruction of heritage features

Main Activity/Action/Process	Phase	Potential Impacts related to environmental aspects
Rehabilitation	Operation Decommissioning Closure	Loss of soil resource
		Disturbance, damage and destruction of biodiversity
		Surface water pollution
		Alteration of natural drainage patterns
		Ground water pollution/contamination
		Visual impact of rehabilitation activities
Maintenance	Operation Decommissioning Closure	Loss and sterilisation of mineral resources
		Loss of soil resource through pollution
		Loss of land capability through pollution
		Alteration of natural drainage patterns
		Surface water pollution from AMD
		Ground water contamination from AMD

5.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

When considering cumulative impacts it is vitally important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the development. On a regional scale, the Mpumalanga province is already heavily affected by mining operations and agriculture. The main impacts which have a cumulative effect at this scale are related to the transportation vectors that they act upon. For example air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

The potential cumulative impacts of the proposed Leiden Coal Mine are listed below in broad terms. It should be noted that part of the methodology for assessing impacts includes the consideration of cumulative impacts. Please refer to Section 7.1 for information on the methodology applied.

- Contribution to losses of potentially productive agricultural land, along with a reduction in land capability as a result of site sterilisation due to mining activities.

  Forestry and other land uses in the area such as agriculture have presumably resulted in significant impacts on soil resources with potential losses in land capability. In the broader context, the Mpumalanga province is heavily impacted by mining activities in particular and as such the mine could contribute to the loss of productive agricultural land.

- Contribution to air quality impacts, specifically relating to increased suspended particulate matter (dust).

Currently the use of unpaved roads in the area around the mine, particularly by heavy logging vehicles, result in significant levels of suspended particulate matter. The introduction of a mine to the area has the potential to result in a cumulative effect on dust levels through increased use of the roads and earthworks activities (particularly during construction).

- Contribution to reduction in surface water quality.

  Testing of surface water quality along with aquatic ecology sampling has indicated that whilst water quality is generally good, there is evidence of water contamination, possibly as a result of historical mining activities. Mining has the potential to contribute to deterioration of water quality if adequate mitigation measures are not implemented.

- Increase in traffic.

  The introduction of mining to the area is expected to result in an increased level of disturbance (traffic, noise etc.) on a localised scale, but this in turn will contribute to a certain degree on capacity and integrity of road infrastructure at a regional level.

- Disturbance of fauna.

  There is currently disturbance of fauna due to the various land use activities that take place within the site and the surrounding area. The introduction of mining to the area is expected to result in an increased level of disturbance (traffic, noise etc.) to fauna.

- Invasion of alien plant species.

  A number of activities and land uses within the site and surrounding area (such as forestry, agriculture, and informal grazing) have resulted in significant disturbance to vegetation communities which has resulted in the spread of alien invasive species. Mining has the potential to result in a further increase in alien invasive vegetation if adequate mitigation measures are not implemented.

- Increase in ambient noise levels and potential adverse effect of noise sensitive receptors.

  Currently ambient noise levels are not high at the site, however if mining takes place, the cumulative effect of mining together with the existing land uses has the potential to result in an increase in the ambient sound level and potential nuisance to sensitive receptors.

- Downstream sedimentation.

  Currently forestry is expected to result in erosion and the introduction of mining to the site may also increase erosion on a localised scale which in turn may result in further sedimentation of downstream water resources.

- Disturbance, damage or destruction of heritage features.

  Forestry and historical agriculture are expected to have resulted in impacts on heritage features within the site and surrounding areas. The introduction of mining to the area could result in a further impact on heritage features if appropriate mitigation measures are not implemented.

- Increased vulnerability and community safety-related risks and impacts.

  Community safety-related risks and impacts already exit as a result of the land uses taking place in the area, particularly forestry. In the event that mining goes ahead, there would potential for increased community safety-related risks and impacts.

- Localised areas of acid mine drainage and groundwater contamination.

  Water quality monitoring indicates that historical mining activities may have resulted in water contamination within the application area. If further mining takes place without adequate mitigation measures in place, there is potential for additional water contamination.

5.3 POTENTIAL FOR ACID MINE DRAINAGE

5.3.1 BACKGROUND TO ACID GENERATION AND METAL MOBILISATION

Acid Mine Drainage (AMD) can be defined as the outflow or seepage of acidic water from old metal or coal mine areas. AMD is comprised of a low pH, iron and sulphate water and it usually occurs when water is exposed to the atmosphere via outflow or seepage, thus oxidising. The creation of acid or ferric hydroxide within the system is as a direct result of iron sulphide or pyrite oxidation. Pyrite is one of the most important sulphides found in the waste rock of mines. Coal-bearing rocks in particular have the potential to generate AMD, because of the low modal distribution of sulphide minerals, i.e. mainly pyrite. It is important to note that exposure to air is a crucial step in AMD formation. Iron sulphides in geologic materials that are located below the water table will remain essentially stable, since the potential for oxidation is limited. However, where sulphidic materials are exposed to oxidising conditions (air) the iron sulphides will react and water can move the reaction products (e.g. iron and sulphate) into surface water and groundwater. As the acid water migrates, it further reacts with other minerals and dissolves a broader range of metals. Once sulphides have been oxidised, it is extremely difficult to avoid ferric hydroxide precipitation.

5.3.2 AMD FORMATION IN THE HIGHVELD, WITBANK, AND ERMELO COALFIELDS

Samples were collected during previous research projects for the Water Research Commission from the coal seams, as well as their roof and floor lithologies in the Highveld, Witbank, and Ermelo coalfields. Acid-base accounting (ABA) results for the collected samples show that the lithological units in the coalfields have the ability to contribute to deterioration in ground and surface water quality. A positive correlation was also recognized between the types of minerals, (modal proportion of sulphide, carbonate, and clay minerals) present in the coal and the associated water quality, i.e. the severity of the AMD problem.

5.3.3 POTENTIAL IMPACTS AND CONSEQUENCES OF AMD

If AMD is incorrectly managed, it has the potential to result in social and environmental impacts as well as long term liability for mine operators, regulators, and the community. The costs of managing AMD after it has occurred can incur millions of Rands. Some of the main social and environmental impacts associated with AMD are:

- Mobilise (bring into solution) metals to levels that may seriously compromise aquatic ecosystems, riparian communities and possibly human health (e.g. zinc, cadmium, aluminium, copper);
- Limit the downstream beneficial uses of the receiving water (e.g. stock, recreation, fishing, aquaculture, irrigation);
- Alter important life supporting balances in water chemistry (e.g. bicarbonate buffering system);
- AMD can cause rehabilitation and re-vegetation difficulties;
- Released chemicals that can result in the smothering of aquatic habitat and reduce light penetration; and
- Limit the reuse of mine site water and exacerbate the corrosion of site infrastructure and equipment.

The above impacts can result in severe consequences which primarily include:

- Long term environmental liabilities for mine operators, regulators and communities; and
- Treatment of AMD requires the installation of expensive control, treatment and rehabilitation programs.

5.3.4 POTENTIAL FOR AMD AT LEIDEN

According to the sediment rock and borehole testing for Leiden during the site visit by the Geochemistry specialists, the geological formation is unlikely to yield AMD formation, these results are discussed further below.

In general, the area has been divided into three lithological units. i.e. dolomite, arenite, and dolerite. Rocks indicated as arenite within the application area are the only rocks that have the potential to host coal. As explained previously, it is the weathering of sulphide minerals, mainly pyrite, which gives rise to the formation of AMD. Coal-bearing rocks have the potential to generate AMD, because of the low modal distribution of sulphide minerals, i.e. mainly pyrite. Arenite and dolerite do not have such potential, because they do not contain any sulphide minerals. As such the potential formation is considered a low risk due to the nature of the predominant geologies of the site.

In general, the coal from the Leiden Colliery is predominantly of the reactive maceral type. The reactive macerals have a lower carbon to hydrogen ratio than the inert macerals.

The most common mineral impurities found in coal samples include clay minerals, sulphide minerals (e.g. pyrite, marcasite, pyrrhotite), and quartz. Insufficient data are currently available to quantify the modal proportions of the acid producing, as well as the buffering mineral impurities contained in the coal.

The negative environmental impact of coal mining at Leiden Colliery has been highlighted in a report by Boer (2003). A positive correlation was identified between low pH levels and elevated salinities. Furthermore, increased levels of sulphate, calcium, magnesium and sodium were detected that entered the environment as a direct result of mining activities.

The importance of a mineralogical study lies in the understanding of the nature in which pollutants are present at the Leiden Colliery, rather than to simply assume the presence of a chemical component without any understanding of its chemical and/or physical properties. Furthermore, the literatures that are currently available merely classify coal in terms of its reflectance, i.e. bright or dull coal. Such a classification is insufficient for the meaningful interpretation of the future geochemical behaviour of the coal or the manner in which it will weather.

The majority of geological information has been gathered in the past with the objective to quantify and optimize the productivity of a Colliery or to explore for new coal reserves. In the history of the Leiden Colliery, the analyses of coal never considered the environmental impact. Considering the volume of available geological data, very little are relevant in terms of the evaluation of the environmental impact.

Please see the Geochemistry specialist report in Appendix F for more detail regarding the ABA undertaken for the Leiden Coal Mine.

The probabilistic simulations suggested that the acid generating potential of the site is limited and that the resulting pH would remain in the near neutral range. This is brought about by the relative large modal proportions of buffering minerals present in these samples from the Leiden Colliery. Furthermore, it has been established that the sulphate values would remain at elevated levels, mainly due to the elevated modal proportions of pyrite in these samples. Toxic heavy metals such as aluminium would be preset at intermediate to elevated levels in these seepage samples.

Regardless of the potential for AMD formation, a proactive approach will be adopted for the Leiden Coal Mine with the development of a detailed AMD avoidance and management strategy to be implemented throughout the LoM.

5.3.5 BEST PRACTICE MANAGEMENT AND CONTROL OF ACID DRAINAGE

If accounted for at the beginning of a project together with an immediate action plan to be put into effect should oxidization begin, AMD can be managed correctly, therefore minimizing the affects to the surrounding environment. Currently, best practice environmental management of sulphidic mine wastes involves integration of acid drainage prevention, minimisation and control into the mining process. It can be summarised as the early characterisation and classification of the acid generating potential of these materials, development of strategies to minimise the oxidation of sulphides, and where acid drainage formation is unavoidable, the implementation of suitable long term control and treatment technologies.

Best practice management of AMD needs to be pre-emptive. As such, the following principles will apply to the AMD avoidance and management strategy for Leiden:

- Understanding the site mechanisms for acid generation, predicting the acid generating potential and incorporating this information into mine design and management (e.g. location of waste dumps, blending of wastes, dump design and management procedures, water management plans, etc.);
- Development of suitable minimisation and control strategies;
- Monitoring to seek warning signs of the early development of acid drainage, and later to quantify the effectiveness of minimisation and control strategies; and
- Treatment where minimisation and control strategies are not totally effective or where costs of treatment are less than the costs of minimisation and control.

In almost all circumstances, resources spent on prevention and minimisations of acid drainage are returned many fold through lower control and treatment costs. The geochemical study undertaken in the EIA Phase will provide the detailed AMD mitigation strategy based on current best practice in terms of avoidance and management of AMD.

6 ALTERNATIVE LAND USE AND DEVELOPMENTS

6.1 ENVIRONMENTAL ASPECTS THAT DESCRIBE THE PRE-MINING ENVIRONMENT

The environmental aspects that describe the pre-mining environment are summarised below. It is important to note that these aspects must be read in conjunction with the detailed description of the baseline receiving environment in Section 3.

- The terrain is comprised of gently to moderately undulating plains;
- Pre-mining soils are of moderate to good agricultural potential and support arable, grazing and wilderness land capabilities;
- Mixed land uses of mostly commercial forestry and grassland;
- A relatively disturbed ecosystem;
- Wetlands, the majority of which are hill slope seepage wetlands;
- Perennial drainage patterns;
- Reasonably good ground and surface water quality; and
- Eastern Highveld grassland and Wakkerstroom Montane Grassland.

The purpose of the list above is to guide the environmental objectives of rehabilitation and closure described in Sections 24 and 25 of this report.

6.2 ALTERNATIVE LAND USES

The current land uses on site comprise of commercial forestry plantations, sawmill operations, cattle grazing, old fields, wilderness and tracts of vacant land. Most of the forestry operations are for timber that is irregularly harvested and processed at the sawmill which is owned and operated by the landowner’s family. Several alternative land use have been discussed in the Integrated Scoping Report. Of these land uses discussed, the following are considered viable alternative land uses and are listed below.

6.2.1 DESCRIPTION OF ALTERNATE LAND USES

6.2.1.1 Mining

Mining is one of the predominant land uses within the surrounding area. Several active mines, predominantly coal mines, are located within 60km of the project area and include Taaiboschspruit, Old Leiden, Kusipong, Saymore, Mooiplaats, Ferreira and Penumbra mines. The mining operations located in the surrounding area can be categorised as open-cast and underground operations with surface access nodes. Additional supporting infrastructure is also present and includes mineral processing plants, slurry and co-disposal facilities, conveyor routes, haul roads, offices, pipelines and powerlines. Furthermore, the proposed application area has been impacted by historic prospecting and mining operations. According to historical prospecting records, a total of 187 000 t (in situ) was mined from the site more than 10 years ago by Kangra Coal (Pty) Ltd. The Leiden Coal Mine project will allow for the optimum mining and usage of mineral resources which still remain within the project area and supply of coal to both the international and domestic markets. As such, mining can be considered a feasible land use alternative within both the application area and surrounding area.

6.2.1.2 Forestry

Forestry is one of the dominant land uses within the immediate and surrounding area. Plantations owned and operated by Mondi, Sappi, TWK and SAFCOL are widespread and occur throughout the surrounding area. The predominant land use on site is also forestry with an operational sawmill located on the property. The plantation and sawmill within the application area are owned and operated by the family of the landowner. Based on several site visits and discussions with the landowner it has been determined that while forestry is the dominant land use on site; it is not effectively commercially exploited due to timber harvesting operations being undertaken at irregular intervals. Forestry operations within the surrounding areas take place on large commercial scales. As such forestry can be considered a feasible land use alternative within both the application area and surrounding area.

6.2.1.3 Mixed Land Use

Mining and forestry have been identified as the predominant land uses within the immediate and surrounding area. The character of the application area confirms this finding, with forestry the dominant land use on site and historic mining also having been undertaken by Kangra Coal (Pty) Ltd. As a land use, mining is often viewed as directly competing and eventually replacing existing land uses. However, the nature of the proposed Leiden Coal Mine (majority underground) provides an opportunity in which both feasible land uses, namely forestry and mining can potentially be conducted concurrently. The proposed Leiden Coal Mine aims to opencast a relatively small area (up to 22 ha) in order to access and mine the underground coal seams at a depth of 20 to 55 m. Due to the small size of the opencast area and with the vast majority of mining taking place deep underground, relatively little surface disturbance is expected to take place which will allow for the potential continuation of forestry as a land use while mining activities are underway. Furthermore, due to the expected depth of mining the risk of subsidence is also greatly reduced. The surface area required for mine infrastructure is also greatly reduced as there will be no mineral processing facilities or tailings dam on the site. The practicalities of undertaking two concurrent, demanding land uses such as forestry and mining are likely to require detailed management of operations to ensure the feasibility of both land uses, but it is potentially possible. As such, a mixed land use of mining and forestry can be considered a feasible land use alternative within both the application area and, possibly, the surrounding area.

6.2.2 DESCRIPTION OF MAIN FEATURES AND INFRASTRUCTURE RELATED TO ALTERNATIVE LAND USE

Forestry remains the only feasible alternative land use at present. This is due to forestry being the current, existing land use on site as well as prevailing land capability. As such, a description of the main features and infrastructure related to cultivated land as a viable alternative land use is discussed below.

As a land use commercial forestry are dependent on two main environmental features both influences by climate namely Mean Annual Precipitation (MAP) and Mean Annual Temperature (MAT). MAP characterises long-term water supply into the region and defines the potential of a growing area assuming factors such as nutrients, available light and a suitable substrate are present. MAT is associated with the amount of heat units available that in turn provide an indication of length of the growing season, the potential evapotranspiration to take place and rate of assimilation. Climate is essentially the main component when developing a proposed commercial forestry site.

In general, commercial forestry plantations require limited infrastructure and instead utilise mobile heavy machinery transported on to and off-site. Heavy machinery and equipment includes knuckleboom loaders, feller bunches and crawler dozers. The most common pieces of infrastructure associated with commercial forestry plantations include (but are not limited to):

- Mobile or container offices;
- Chemical toilets;
- Vehicle parking areas;
- Engineering bays;
- Wash bays;
- Workshops;
- Waste disposal areas;
- Salvage yards;
- Loading and storing yards;
- Firebreaks; and
- Storm water management infrastructure

Infrastructure requirements for commercial forestry plantations are notably less than the infrastructure required for mining as a land use. Furthermore, infrastructure requirements for commercial forestry are also likely to be temporary and mobile, whereas mining may require permanent or semi permeant placement of infrastructure.

6.2.3 MAP SHOWING THE LOCATION AND AERIAL EXTENT OF ALTERNATIVE LAND USE

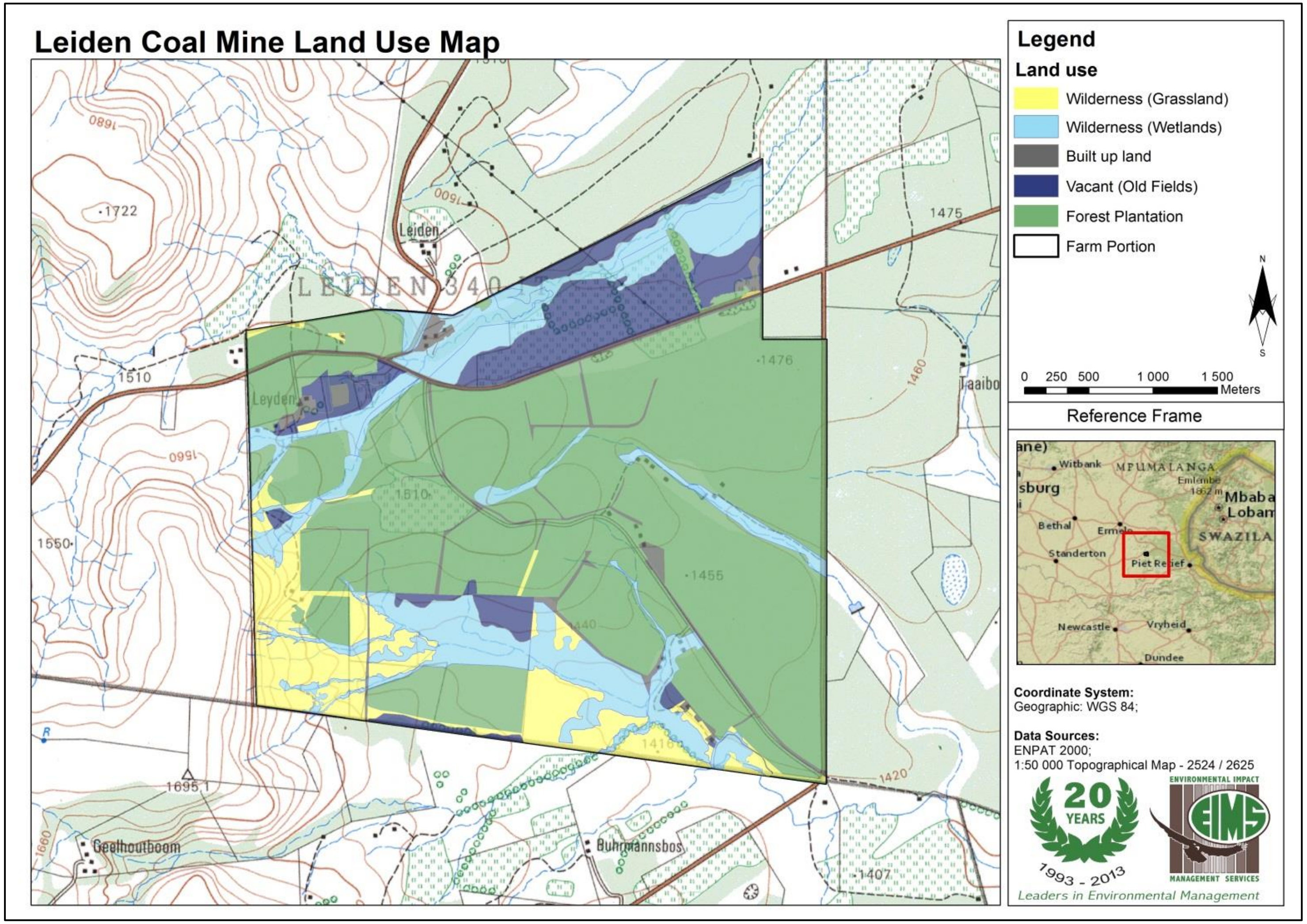


Figure 55: Location and aerial extent of current land uses

6.3 DEVELOPMENT ALTERNATIVES

The identification and assessment of alternatives is a key component to the success of the EIA process. During the Scoping phase three feasible project alternatives were identified for further assessment during the EIA phase.

All three alternatives were assessed by all specialists appointed to the project. These three development alternatives are presented below, have been comparatively assessed, and a summary provided. As such, the development alternatives for the proposed Leiden Coal Mine are as follows:

6.3.1 ALTERNATIVE 1: NO GO ALTERNATIVE

This alternative implies that no mine development takes place and that the environment remains unchanged and unaltered. At present, the proposed development site for the Leiden Coal Mine is comprised of a mixture of "undisturbed" natural vegetation and extensive forestry plantation. The No-Go Alternative will entail the continuation of the current land uses on site which are comprised of commercial forestry plantations, sawmill operations, cattle grazing, old field, wilderness and tracts of vacant land.

It is worth noting that other than the isolated wetland and grassland areas, the proposed project is located in an area that is dominated by forestry plantations, the result of which is low overall biodiversity. Despite overall low biodiversity, the surrounding area (including the property under Mining Right Application) is included in the Mpumalanga Tourism and Parks Agency's (MTPA) proposed Wakkerstroom Wet Grassland Protected Environment.

The No-Go Alternative will result in no mining related impacts being experienced by the receiving environment. The biophysical impacts likely to be experienced by the selection of this alternative include those related to commercial forestry plantations and grazing. However, if the proposed Leiden Coal Mine development does not proceed it is likely that no additional socio-economic benefits would be created in the area, the mineral resource will be lost and additional employment opportunities and GDP from coal export compromised.

6.3.2 ALTERNATIVE 2: MAXIMUM MINE PRODUCTION

In this alternative, the mining and production of coal is emphasised. Less restrictive mitigation measures will be utilised to protect environmental features, thus allowing for the maximum production of coal. This alternative will increase the financial viability of the proposed Leiden Coal Mine at the potential cost of impacting on more environmental features than the Sensitivity Planning Approach.

This alternative is likely to increase landscape character changes and impact on aspects such as land use, employment, hydrology and isolated pockets of biodiversity, as mining operations will likely move through sensitive environmental features and mine the area under application through the use of both open-cast and underground mining methods. In terms of bio-physical aspects, the Maximum Mine Production Alternative is likely to experience similar impacts in nature to the Sensitivity Planning Approach however these impacts will be exacerbated by the extension of the mine through open-cast and underground mining methods.

Furthermore, the combination of extended open-cast and underground mining is likely to further exacerbate environmental impacts in terms of their spatial and temporal scales as well as contribute to the cumulative impact on these aspects. Alternative 2 also has further financial implications in terms of the Applicants capacity to manage the environment as well as remediate environmental pollution and contamination. Notable impacts exacerbated by the selection of this alternative include the direct destruction of wetlands, a river diversion, and increase in dust fall out and noise nuisance and extended groundwater dewatering and contamination

6.3.3 ALTERNATIVE 3: SENSITIVITY PLANNING APPROACH

This alternative emphasises resource (bio-physical and socio-economic) protection and uses stringent measures to identify locations within the proposed area that are both (relatively) suitable and unsuitable for mining operations. This alternative relies heavily on specialist planning and evaluation to identify areas of consolidated sensitivities that should, as far as is practically possible, be avoided. Included in this alternative is the assessment of mining method (open-cast vs underground) as well as infrastructure placement. As such, Alternative 3: Sensitivity Planning Approach includes the reduction of the open-cast in favour of underground mining only and the design and placement of infrastructure in areas of overall low environmental sensitivity as delineated by the consolidated sensitivity mapping undertaken.

Furthermore, this alternative allows for the continuation of the existing land use which in turn provides the local economy a net gain in terms of both income and employment in a municipality in which both are required. The concurrent existence of both land uses, namely commercial forestry and mining, will also result in less socio-economic disruptions to the livelihoods of people living and working on the landowner operated forestry plantation.

In addition, this alternative allows for a reduction in the temporal and spatial scales of mining related impacts as the mining operations is restricted to the use of underground mining and specific locations for infrastructure placement. The reduction in these impact scales is significant in terms of cumulative impacts and improves the Applicants' capacity to manage the environmental impacts as well as remediate environmental pollution and contamination.

If the proposed Leiden Coal Mine is to be approved, it is the recommendation of the Environmental Assessment Practitioner (EAP), which is supported by the specialist studies undertaken, that Alternative 3 – Sensitivity Planning Approach be the development alternative that is approved.

6.4 COMPARATIVE LAND USE ASSESSMENT

6.4.1 ALTERNATIVE LAND USES THAT COULD BE IMPACTED ON

The current and feasible alternative land use that will be impacted on by the proposed Leiden Coal Mine is that of large scale commercial forestry plantations which is undertaken by the landowner. At the national scale, commercial forestry plantations consist of millions of hectares of tree monocultures which are based on a few species such as Eucalyptus or Pines.

These species are selected and are cultivated for rapid growth, uniformity and high yields of raw material in order to ensure continuous supply of product to the paper industry. These monocultures are invariably planted in even-aged stands that require intensive soil preparation, water use, fertilisation, regular spacing of trees, seedling selection, mechanical and/or chemical weeding and quick mechanised harvesting done in rotation.

6.4.2 POTENTIAL IMPACTS OF ALTERNATIVE LAND USE OR DEVELOPMENT

As an existing and feasible alternative land use, the potential impact of commercial forestry plantations and timber harvesting are broadly described below. Potential impacts include (but are not limited to) the following:

Biodiversity:

- Disturbance, damage, reduction in and destruction of overall biodiversity through the clearing, preparation, maintenance and timber harvesting operations of commercial forestry plantations.

Heritage:

- Disturbance, damage and destruction of cultural/heritage features through the clearing, preparation, maintenance and timber harvesting operations of commercial forestry plantations.

Ground Water:

- Increased use of groundwater resources as a result of plantation water use requirements in order to optimally cultivate monocultures;
- Reduced availability of groundwater for other users as a result of plantation water use requirements; and
- Pollution of groundwater resources as a result of the widespread use of fertilisers and other chemical additives including pesticides.

Surface Water:

- Pollution of surface water resources as a result of the widespread use of fertilisers and other chemical additives including pesticides; and

- Reduction in the availability of surface water run-off entering adjacent surface water resources as a result of plantation water use requirements.

Soils, Land Use and Land Capability:

- Loss of the soil resource as a result of short term crop rotations, use of heavy machinery and erosion;
- Pollution of the soil resources as a result of the widespread use fertiliser and other chemical additives including pesticides; and
- Loss or reduction in land capability as a result of the loss of the soil resource and its overexploitation.

Mineral Resources:

- Sterilisation of mineral resources as surface land use often competes with a proposed mining land uses thereby impeding or halting the potential extraction of minerals.

The potential impacts listed above are broad and have not been assessed in any significant detail in this report. They are a general indication of the likely impacts of the current and feasible land use alternative, namely commercial forestry plantations on the receiving environment. It is worth noting that the likely impacts experienced as a result of the alternate land use described above are, in general, likely to be significantly less than the impact of mining as a land use in terms of nature, extent and severity.

6.4.3 DESCRIPTION OF POTENTIAL CUMULATIVE IMPACTS OF ALTERNATIVE LAND USES OR DEVELOPMENTS

The potential cumulative impacts of commercial forestry plantations as an alternative land use include the following:

- Disturbance, damage, reduction in and destruction of overall biodiversity through the clearing, preparation, maintenance and timber harvesting operations of commercial forestry plantations;
- Disturbance, damage and destruction of cultural/heritage features through the clearing, preparation, maintenance and timber harvesting operations of commercial forestry plantations;
- Reduced availability of groundwater for other users as a result of plantation water use requirements;
- Pollution of groundwater resources as a result of the widespread use of fertilisers and other chemical additives including pesticides;
- Pollution of surface water resources as a result of the widespread use of fertilisers and other chemical additives including pesticides;
- Reduction in the availability of surface water run-off entering adjacent surface water resources as a result of plantation water use requirements;

- Loss of the soil resource as a result of short term crop rotations, use of heavy machinery and erosion;
- Pollution of the soil resources as a result of the widespread use fertiliser and other chemical additives including pesticides;
- Loss or reduction in land capability as a result of the loss of the soil resource; and
- Sterilisation of mineral resources as surface land use often competes with proposed mining land uses.

The potential cumulative impacts listed above are broad and have not been assessed in any significant detail in this report and are a general indication of the likely impacts of the alternate land uses on the receiving environment likely to contribute toward cumulative impacts.

6.4.4 LIST OF POTENTIAL IMPACTS ON SOCIO-ECONOMIC CONDITIONS OF THIRD PARTY LAND USE ACTIVITIES

Potential impacts on the socio-economic conditions of third party land use activities both on site and in the surrounding area are discussed in detail in Section 7 and broadly listed below:

- Loss and impedance of current land uses;
- Economic impacts (both positive and negative);
- Blasting hazards;
- Noise impacts;
- Dust impacts; and
- Sense of place impacts;

6.4.5 POTENTIAL IMPACT ON CULTURAL ASPECTS AND HERITAGE FEATURES

A large number of cultural and heritage features have been identified within the proposed Leiden application area and surrounds. These features include cemeteries, graves, historical structures, historical mine shafts and a possible rock art site.

It is possible that that further cultural and heritage features may be uncovered during the proposed development of the Leiden Coal Mine however this is highly unlikely as the site has been subject to long-term forestry activities. Regardless, the potential impacts on cultural and heritage features include the loss of these resources for future generations through activities that may result in the disturbance, damage and destruction of these features. These features and resources are protected by national legislation, specifically the National Heritage Resources Act (NHRA, Act No 25 of 1999.) and require mitigation prior to any disturbance.

6.4.6 QUANTIFICATION OF IMPACTS ON SOCIO-ECONOMIC CONDITIONS

In order to undertake the quantification of impacts on socio-economic conditions an Economic Impact Assessment for alternate land use was undertaken. The purpose of the study was to determine if the economy would benefit as a result of a change in current land use i.e. commercial forestry plantations, to a mining land use. As such, an economic analysis/impact assessment of the economic costs and benefits of the area under application was undertaken. The full report is attached in Appendix E.

The primary methodology used in the economic analysis/impact assessment is aimed at measuring the economic value and employment created (and lost) by forging ahead with the proposed Leiden Coal Mine as the future land use.

Employment is a familiar and easy concept to understand, while income generation, as a concept is wider than simply household income and deserves further clarity. Income generation, in economic terms is essentially the sum of salaries, wages and operating profit. These variables together make up Economic Value Added (EVA), also known as Gross Geographic Product (GGP) or Gross Domestic Product (GDP).

It is important to note that assessment undertaken and calculations determined were done so whilst utilising the precautionary principle. This entailed erring on the potential benefits of the mine and increasing the benefit of the current, existing land use to its best potential (which it currently is not). As such, all calculations determining potential benefits of the mine were calculated conservatively against the best potential value of the current land use. As a result, the calculation of the potential economic benefits of the mine have been done after diluting much of its potential benefits, accounting for systemic risk of mine failures, utilising historic mine GDP as opposed to budgeted values included in the Applicants financial forecast and further reducing the benefits of the mine over an economic generation of 32 years.

From the assessment, the following quantifiable and qualifiable benefits to the local economy as a result of the proposed Leiden Coal Mine were determined:

- The R 41 million investment proposed by the Applicant is not large relative to most mine investments. However, due to the small size of the Mkhondo Local Economy, a R 41 million investment represents 8% of the current investment level in the municipal economy and is thus a substantial investment;
- Due to the intensive capital nature of mining, job creation per hectare is high when compared to agriculture and forestry. In essence, the GDP per employee in mining is much larger than most other industries and is four times the number for GDP per employee in the agricultural and forestry sector (see Figure 56);

Figure 56: Established jobs per hectare (2011)

- The mine is likely to add a potential 35 fulltime economic employees, relative to the loss of 8 employment opportunities. Although the 102-117 employment options created is not substantial when compared to the 18 651 jobs already in existence, it does provide a positive signal to the local economy and for every 1 job created there are an estimated 4 people who are dependent on this job in the local area. As such, the 102 – 117 employment opportunities at the mine are likely to provide for the well-being of 408-468 people;
- The Mkhondo GDP in 2013 was R5.5 billion and over a ten year period the mine could increase this base by 1.2% on a direct basis. Multipliers in such a small economy are generally minute due to its small capacity and hence a calculation thereof is not significant. The increase in multipliers in the informal economy is often much larger and the quantification thereof will be an extensive study, which at this point is not deemed essential;
- The mine may well increase exports of the local economy by 4% per annum, for a period of 10 years;
- Excluding VAT and PAYE, the taxes on production of the Mkhondo economy is estimated at only R78 million per annum. Unfortunately these economic estimates are based on historical data extrapolations and updated surveys. The applicant has budgeted for taxes and royalties of R50 million per annum and this could increase the municipality's tax contribution's significantly;

- The Mkhondo local economy has performed very poorly in recent times and much of this could be ascribed to a deteriorating timber industry (based on reduced demand for paper.) An investment in the local economy will certainly increase business confidence in the area;
- The Mpumalanga province in general has strong locational advantages in coal mining, and this investment would continue to strengthen this aspect;
- The balance-of-payments position of a country, or expected changes in transactions with the rest of the world, is the most direct determinant of a country's exchange rate stability. Small as it might be on a national scale, the increase in foreign exchange earnings of the mine will assist the country’s forex position; and
- Inflation is simply a persistent increase in prices without a corresponding increase in productivity or economic activity. In this regard, the impact of the mine is too small to cause any undue inflationary concerns in the local economy.

In summary, the economic assessment undertaken determined that the proposed Leiden Coal Mine is likely to add an additional **R 9.00 in GDP** for every **R 1.00** opportunity cost lost. This finding essentially indicates that if the proposed Leiden Coal Mine is approved and mining activity commences, it is likely to have nine times as much economic benefit as opposed to a continuation of the current, existing land use namely commercial forestry operations.

7 ASSESSMENT AND EVALUATION OF POTENTIAL PROJECT IMPACTS

7.1 THE IMPACT ASSESSMENT METHODOLOGY

Method of Assessing Impacts:

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). Please note that the impact assessment must apply to the identified Sub Station alternatives as well as the identified Transmission line routes.

Determination of Environmental Risk:

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R)}{4} \times N$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 22.

Table 22: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)

Aspect	Score	Definition
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.

Aspect	Score	Definition
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 23.

Table 23: Probability Scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

Table 24: Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 25.

Table 25: Significance Classes

Environmental Risk Score	
Value	**Description**
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

<u>Impact Prioritisation:</u>

In accordance with the requirements of Regulation 31 (2)(l) of the EIA Regulations (GNR 543), and further to the assessment criteria presented in the Section above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 26: Criteria for Determining Prioritisation

Public response (PR)	Low (1)	Issue not raised in public response.
	Medium (2)	Issue has received a meaningful and justifiable public response.
	High (3)	Issue has received an intense meaningful and justifiable public response.
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact

		will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 11. The impact priority is therefore determined as follows:

Priority = PR + CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to Table 27).

Table 27: Determination of Prioritisation Factor

Priority	Ranking	Prioritisation Factor
3	Low	1
4	Medium	1.17
5	Medium	1.33
6	Medium	1.5

7	Medium	1.67
8	Medium	1.83
9	High	2

In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 28: Final Environmental Significance Rating

Environmental Significance Rating	
Value	**Description**
< -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ -10 < -20	Medium negative (i.e. where the impact could influence the decision to develop in the area).
≥ -20	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
0	No impact
< 10	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 < 20	Medium positive (i.e. where the impact could influence the decision to develop in the area).
≥ 20	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

7.2 CULTURE AND HERITAGE IMPACTS

The following is a summary of the cultural and heritage impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the three project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.2.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.2.2 CONSTRUCTION PHASE

7.2.2.1 Impact on Palaeontology

Due to the location of the proposed Leiden coal mine, there is the possibility that paleontological features exist in the area that may be affected/unearthed by the proposed mining activities.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17	-9.75	-14.62
Alternative 3 (Sensitivity planning approach)	-16	-9	-13.5

7.2.2.2 Impact on Stillborn Graves

The potential exists for the damage, destruction, or disturbance of stillborn graves and within the mining footprint to occur. Graves are irreplaceable but can be relocated thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13.5	-6.5	-11.91
Alternative 3 (Sensitivity planning approach)	-13.5	-6.5	-11.91

7.2.3 OPERATION PHASE

7.2.3.1 Impact on Palaeontology

Underground mining may potentially unearth paleontological features that may exist under the proposed Leiden coal mining area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17	-9.75	-14.62
Alternative 3 (Sensitivity planning approach)	-16	-9	-13.5

7.2.3.2 Impact on Stillborn Graves

The potential exists for the damage, destruction, or disturbance of graves and cemeteries within the mining footprint. The graves are irreplaceable but can be relocated by thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13.5	-6.5	-11.91
Alternative 3 (Sensitivity planning approach)	-9	-3.25	-5.41

7.2.4 DECOMMISSIONING PHASE

No impacts have been identified for this phase.

7.2.5 REHABILITATION AND CLOSURE PHASE

No impacts have been identified for this phase.

7.2.6 ALTERNATIVE IMPACT DISCUSSION

If a comparison is drawn between the three different mining development Alternatives, it is clear that three different impact levels can be ascribed to the three Alternatives. Of the three, the No Go Option (Alternative 1) will have the least impact on heritage resources. This is due to the fact that in this Alternative no mining development will take place. With no mining development taking place no mining-related impacts on the area’s heritage resources will take place.

The Maximum Mine Production Option (Alternative 2) will entail the most extensive mining footprint and as a result will represent the Alternative with the highest potential impact on the heritage resources from the area. Two potential impacts have been identified namely the impact of this mining Alternative on palaeontology as well as its potential impact on stillborn babies which may be associated with two black homesteads depicted on a historic topographic map. While a moderate negative impact significance has been calculated for the impact of this Alternative on palaeontology, a moderate negative impact significance has been calculated in terms of the potential impact of the implementation of this development alternative on stillborn babies which may be associated with the two former homesteads.

The Sensitivity Planning Approach (Alternative 3) will have a smaller footprint area designed in such a way to lessen the impact of the proposed development on the environmental sensitivities and constraints identified within the landscape. While a moderate negative impact significance has been calculated for the impact of this Alternative on palaeontology, a low negative impact significance has been calculated in terms of the potential impact of the implementation of this development Alternative on stillborn babies which may be associated with a former homestead situated in close proximity to the development area.

It is therefore evident that although very little difference in impact significance could be calculated for the two Alternatives in terms of the impact on palaeontology, the potential impact on possible stillborn babies associated with former homesteads in this area is significantly less in terms of the Sensitivity Planning Approach than what it is in terms of the Maximum Mine Production Alternative.

7.2.7 CONCLUSION

While Alternative 1 will entail the least impact on heritage resources, of the two development Alternatives, Alternative 3 was calculated to have a lower impact significance in terms of heritage than Alternative 2. Hence, in the opinion of the specialist Alternative 3 is the preferred option from a heritage perspective should mining taking place.

7.3 SOCIAL IMPACTS

The following is a summary of the socio-economic impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.3.1 PLANNING AND DESIGN PHASE

7.3.1.1 Perceptions

The perceptions surrounding the proposed mine to be introduced into the area has been received as a positive impact for the area. Some stakeholders, especially some of the farmers with previous experience of living close to a mine are against the project, mainly due to the potential impact on their livelihoods, specifically the water they use. Other stakeholders think that the mine will be a much-needed economic injection into the area and that local communities (rich and poor) will benefit from having a mine in the area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	13.75	10	11.66
Alternative 3 (Sensitivity planning approach)	13.75	10	11.66

7.3.1.2 Expectations

The introduction of the proposed Leiden coal mine to the area has been received well and great interest has been received. However the potential positive impact on the mines existence within the area must be managed.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-12	-18
Alternative 3 (Sensitivity planning approach)	-15	-12	-18

7.3.1.3 Social Licence to Operate

There is a large public demand for employment opportunities to be made available within the area, as such the proposed Leiden coal mine is seen as a positive impact for the area and its commencement is supported by a large group of I&AP's.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	16.25	17.5	23.33
Alternative 3 (Sensitivity planning approach)	16.25	17.5	23.33

7.3.2 CONSTRUCTION PHASE

7.3.2.1 Health Impacts

The proposed mining operations have the potential to affect the surrounding communities health. For this reason, the mining operations are often seen by interested and affected parties as having a negative impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	23.75	-22.5	-45
Alternative 3 (Sensitivity planning approach)	23.75	-22.5	-45

7.3.2.2 Social Vices

The problems associated with an influx of people include an increased occurrence and practice of social vices such as alcohol abuse, drug abuse, prostitution and teenage pregnancies.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-20	-15	-25
Alternative 3 (Sensitivity planning approach)	-20	-15	-25

7.3.2.3 Community Tension and Family Impacts

The presence of strangers in the community can cause tension and family impacts such as an increase in domestic violence and rape.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-12	-20
Alternative 3 (Sensitivity planning approach)	-17.5	-12	-20

7.3.2.4 Crime and Violence

As a result of the influx of migrants to the area, associated rising crime and violence and a general breakdown of law and order may occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.7	-13	-21.66
Alternative 3 (Sensitivity planning	-17.7	-13	-21.66

approach)			

7.3.2.5 Conduct of Contractors

Contractors employed by the mine may behave in a manner that is not acceptable to the local communities, such a driving recklessly, not abiding to environmental protocols, littering and fraternising with the local population in an unacceptable manner.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-10	-15
Alternative 3 (Sensitivity planning approach)	-11	-10	-15

7.3.2.6 Traffic from a Safety and Nuisance Perspective

Communities have concerns about the increase in traffic and safety as a result of the proposed mining activities commencing in the area

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-10	-16.66
Alternative 3 (Sensitivity planning approach)	-11	-10	-16.66

7.3.2.7 Dust from a Nuisance and Livelihood Perspective

Communities have concerns about the air quality and the affects air quality will have on the flora and fauna as a result of the proposed mining activities commencing in the area.

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-8.25	-13.75
Alternative 3 (Sensitivity planning approach)	-15	-8.25	-13.75

7.3.2.8 Sense of Place

The current status quo of the area where the proposed Leiden Coal Mine is to be located is one of a rural setting. The construction phase is associated with significant activities and this may influence the way in which residents value the area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16.25	-14	-23.33
Alternative 3 (Sensitivity planning approach)	-16.25	-14	-23.33

7.3.2.9 Economic Impacts

The proposed Leiden mine will create new opportunities and this is a positive economic impact offering semi-skilled and unskilled workers employment which can be employed from the local area

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	21.25	22.5	33.75
Alternative 3 (Sensitivity planning	21.25	22.5	33.75

approach)			

7.3.2.10 Impacts Associated with a Construction Camp

The impacts associated with a construction camp include health impacts, social vices, community tension, crime, traffic, dust and nuisance aspects like noise. In addition, construction camps also have environmental impacts.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-11	-16.5
Alternative 3 (Sensitivity planning approach)	-15	-11	-16.5

7.3.2.11 Water from a Livelihoods Perspective

The surrounding farmers are concerned about their water resources and the potential impact that the mine may have on it. Water contamination can affect the farmers livelihoods severely.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-23.75	-18	-36
Alternative 3 (Sensitivity planning approach)	-23.75	-18	-36

7.3.3 OPERATION PHASE

7.3.3.1 Light Pollution from a Sense of Place Perspective

The current status quo of the area is rural, as such the lights that the mine would install have the potential to affect the sense of place at night.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-6.75	-7.87
Alternative 3 (Sensitivity planning approach)	-10	-6.75	-7.87

7.3.3.2 Dust from a Nuisance and Livelihood Perspective

The commencement of the operation phase will impact further on the air quality increasing the dust and coal found in the air. This impact however will be higher in an opencast as opposed to underground mining.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-13	-23.83
Alternative 3 (Sensitivity planning approach)	-17.5	-13	-23.83

7.3.3.3 Impacts Associated with the Transport of Workers

Operational impacts associated with the transport of workers may potentially cause an increase in traffic, additional wear and tear on the existing road, dust and noise.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-12	-18

Alternative 3 (Sensitivity planning approach)	-15	-12	-18

7.3.3.4 Blasting and Vibrations from a Social Perspective

Many of the people in the rural settlements live in traditional houses constructed from clay and poles. These houses are especially vulnerable to impacts associated with blasting and vibrations during open cast and shaft sinking operations.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-20	-15	-22.5
Alternative 3 (Sensitivity planning approach)	-20	-15	-22.5

7.3.3.5 Impact on Social and Physical Infrastructure

There is a shortfall of housing infrastructure within the area and thus the area would not support the workers living in the surrounding areas. However the intention of the mine is to house all their employees in Piet Retief. Should this be successful the impact will be minimal.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-13	-17.3
Alternative 3 (Sensitivity planning approach)	-17.5	-13	-17.3

7.3.3.6 Impact on Community Relations

During the operational phase tension may occur between conflicting land uses.

Alternative	Pre-Mitigation	Post-	Final

	Score	Mitigation Score	Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-13	-17.3
Alternative 3 (Sensitivity planning approach)	-13	-13	-17.3

7.3.3.7 Crime and Violence

As a result of the influx of migrants to the area, associated rising crime and violence and a general breakdown of law and order may occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-14	-23.33
Alternative 3 (Sensitivity planning approach)	-14	-14	-23.33

7.3.3.8 Economic Impacts

The opportunities for semi-skilled and unskilled workers to be employed from the local area will have a significant positive local impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	21.25	22.5	37.5
Alternative 3 (Sensitivity planning approach)	21.25	22.5	37.5

7.3.3.9 Relocation

At present this impact is unlikely to occur, however should relocation be required, significant impacts to the associated peoples livelihoods could occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-22.5	-21.25	-38.95
Alternative 3 (Sensitivity planning approach)	-22.5	-21.25	-38.95

7.3.4 DECOMMISSIONING PHASE

7.3.4.1 Loss of Jobs and Economic Opportunities

As the mine initiates the decommissioning phase less workers will be required to service the mining operations. As such there is the potential for job losses to occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-17.5	-32.08
Alternative 3 (Sensitivity planning approach)	-21.25	-17.5	-32.08

7.3.5 REHABILITATION AND CLOSURE PHASE

7.3.5.1 Expectations

There are social implications associated with the closure of the mine. The mine must ensure that sustainable communities remain after the mine closes.

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-11	-18.33
Alternative 3 (Sensitivity planning approach)	-13	-11	-18.33

7.3.5.2 Re-Instatement of Livelihoods

The development of an SLP will allow for the assessment of the surrounding communities livelihoods post closure. The expectations about the quality of the rehabilitation of the affected areas will be an important consideration. People may want to re-engage in pre-mining activities, and this may not be feasible. There may also be different opinions about potential new land uses.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	14	17	22.66
Alternative 3 (Sensitivity planning approach)	14	17	22.66

7.3.6 ALTERNATIVE IMPACT DISCUSSION

Alternative 1 (The No Go option) is the preferred option for many of the farmers since it will allow them to continue with business as usual and ensure that there are no environmental impacts that may impact on their livelihoods. The municipality and traditional authority do not support the No Go Alternative (Alternative 1) since they welcome development and the associated economic benefits to the broader community in the area, where high unemployment and slow economic growth is the norm.

It is unlikely that any of the Alternatives will result in the relocation of people, which will be a key social impact. The predicted social impacts will take place irrespective of the Alternative. The extended opencast (Alternative 2) will cause more environmental impacts with social dimensions that the reduced opencast Alternative (Alternative 3). Although it will generate profit faster, and therefore allow the SLP to be implemented faster, the long-term impact on livelihoods of surrounding communities must be considered.

7.3.7 CONCLUSION

From a social perspective, the reduced opencast (Alternative 3) will be the preferred Alternative as it takes environmental sensitivity into consideration which directly impact on the livelihoods of surrounding landowners.

7.4 ECONOMIC IMPACTS

The following is a summary of the economic impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the three project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.4.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.4.2 CONSTRUCTION PHASE

7.4.2.1 Property Values

The presence of mining operations within the area may cause the surrounding property values to decrease.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-8.75	-8.75	-10.20
Alternative 3 (Sensitivity planning approach)	-8.75	-8.75	-10.20

7.4.2.2 GDP (Through Investment) Addition to Economy

The mine will have a positive impact on the local GDP.

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	16.25	16.25	16.25
Alternative 3 (Sensitivity planning approach)	-8.75	16.25	16.25

7.4.2.3 Employment Addition to Economy

The proposed Leiden coal mine will require provide employment to both skilled and unskilled labourers in the surrounding are.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	15	15	22.5
Alternative 3 (Sensitivity planning approach)	16.25	15	22.5

7.4.2.4 Timber Security Impacts

The proposed mining operations may negatively impact on the timber industry as the proposed mine is located within an agricultural land use already.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-5	-6.66
Alternative 3 (Sensitivity planning approach)	15	-5	-6.66

7.4.2.5 Food Security Impacts

Competition for agricultural land by mines may potentially impact on food security.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1
Alternative 3 (Sensitivity planning approach)	-10	-1	-1

7.4.3 OPERATION PHASE

7.4.3.1 Annual GDP

The mine will have a positive impact on the local GDP.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	17.5	17.5	26.25
Alternative 3 (Sensitivity planning approach)	-1	17.5	26.25

7.4.3.2 Employment Addition to Economy

If granted, the Leiden coal mine will create additional employment in the area and boost the economy.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	16.25	16.25	26.25
Alternative 3 (Sensitivity planning approach)	17.5	16.25	24.37

7.4.3.3 Tax and Fiscal Contribution

If granted, the Leiden coal mine may contribute to an increase in tax and fiscal contributions.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	17.5	17.5	17.5
Alternative 3 (Sensitivity planning approach)	16.25	17.5	17.5

7.4.3.4 Forex contribution

Should the Leiden coal mine be granted, the increase in foreign exchange earnings will assist the country's forex position.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	17.5	17.5	17.5
Alternative 3 (Sensitivity planning approach)	17.5	17.5	17.5

7.4.4 DECOMMISSIONING PHASE

7.4.4.1 Decrease in GDP

During the decommissioning phase a decrease in the GDP will occur as a result of the mine drawing to a close, this will therefore negatively affect the local GDP.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-25
Alternative 3 (Sensitivity planning approach)	17.5	17.5	32.08

7.4.5 REHABILITATION AND CLOSURE PHASE

No impacts have been identified for this phase.

7.4.6 ALTERNATIVE IMPACT DISCUSSION

The two opposing land-uses is that of coal mining on the one hand versus agriculture/timber land on the other. The current land uses on site comprise of commercial forestry plantations, sawmill operations, cattle grazing, old fields, wilderness and tracts of vacant land. The plantation and sawmill within the application area are owned and operated by the family of the landowner. Based on several site visits and discussions with the landowner it has been determined that while forestry is the dominant land use on site; it is not effectively commercially exploited due to timber harvesting operations being undertaken at irregular intervals. In addition to this, it has been determined that the sawmill operation can be continued with, and hence this is not considered as an economic loss.

This cost-benefit analysis takes cognisance of the fact that the different mining Alternatives may have different land-size (hectare) impacts on the surface land. These are:

- Alternative 1: No go
- Alternative 2: Maximum mine production (extended open cast)
- Alternative 3: Sensitivity planning approach (reduced open cast)

However, in terms of the key assumption of this analysis, namely that the whole of the land-area under consideration will be lost to agriculture/timber, the Alternatives do not make a difference to this analysis. In essence, from an economic Alternative land-use perspective, the different mining Alternatives are considered to be one given that the number of jobs created and the hectares change in land-use are the same for the Alternative land-uses. Again this is because this analysis works on the basis that the whole land-area is lost to agriculture/timber, even though there are indications that the timber plantation could be continued with during mining, or rejuvenated after mine closure. The approach taken is one of ultra-economic conservatism in the favour of agriculture/timber.

7.4.7 CONCLUSION

The Alternative mine option two, assuming the gross output of the two Alternatives are marginally the same, would be best from an integrated sustainable development point of view. In conclusion, and assuming the environmental and social costs are mitigatable to acceptable standards, then this mine development ought to be welcomed from an economic development perspective.

7.5 GEOCHEMISTRY

The following is a summary of the geochemistry impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the three project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.5.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.5.2 CONSTRUCTION PHASE

No impacts have been identified for this phase.

7.5.3 OPERATION PHASE

7.5.3.1 Impact of AMD on Stream Ecology

Acid drainage can have extreme impacts on the ecology of streams, affecting the beneficial use of waterways downstream of mining operations.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning approach)	-16.25	-9	-18

7.5.3.2 Mobilisation of Heavy Metals

Acid can mobilise (bring into solution) metals to levels injurious to aquatic ecosystems, riparian communities and possibly human health (e.g. zinc, cadmium, aluminium, copper)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning approach)	-16.25	-9	-18

7.5.3.3 Limitations on Beneficial Downstream Water Uses

Acid can limit the downstream beneficial uses of the receiving water (e.g. stock, recreation, fishing, aquaculture, irrigation)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.3.4 Alteration of Water Chemistry Balance

Acid can alter important life supporting balances in water chemistry (e.g. bicarbonate buffering system).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning	-16.25	-9	-18

approach)			

7.5.3.5 Development of Chemical Precipitates

Acid can lead to the development of chemical precipitates (e.g. ferric hydroxide, aluminium hydroxide etc.) that can smother aquatic habitat and reduce light penetration.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning approach)	-16.25	-9	-18

7.5.3.6 Development of Acid Conditions

Acid conditions can lead to the installation of expensive control, treatment and rehabilitation programs.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning approach)	-16.25	-9	-18

7.5.3.7 Long Term Environmental Liabilities

Poor acid conditions can create long term environmental liabilities post closure.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning approach)	-16.25	-9	-18

7.5.3.8 Limitations on Mine Site Water Reuse

Poor acid conditions can limit the reuse of mine site water and exacerbate the corrosion of site infrastructure and equipment.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-15	-30
Alternative 3 (Sensitivity planning approach)	-16.25	-9	-18

7.5.4 DECOMMISSIONING PHASE

7.5.4.1 Impact of AMD on Stream Ecology

Acid mine drainage can have extreme impacts on the ecology of streams, affecting the beneficial use of waterways downstream of mining operations even after mining ceases.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-5.5	-11

7.5.4.2 Mobilisation of Heavy Metals

Acid can mobilise (bring into solution) metals to levels injurious to aquatic ecosystems, riparian communities and possibly human health (e.g. zinc, cadmium, aluminium, copper)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-17.35
Alternative 3 (Sensitivity planning approach)	-18.75	-5.5	-11

7.5.4.3 Limitations on Beneficial Downstream Water Uses

Acid can limit the downstream beneficial uses of the receiving water (e.g. stock, recreation, fishing, aquaculture, irrigation)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-5.5	-11
Alternative 3 (Sensitivity planning approach)	-18.75	-18.75	-11

7.5.4.4 Alteration of Water Chemistry Balance

Acid can alter important life supporting balances in water chemistry (e.g. bicarbonate buffering system)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-5.5	-11

7.5.4.5 Development of Chemical Precipitates

Acid can lead to the development of chemical precipitates (e.g. ferric hydroxide, aluminium hydroxide etc.) that can smother aquatic habitat and reduce light penetration

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-9	-11

7.5.4.6 Development of Acid Conditions

Poor acid conditions can lead to the installation of expensive control, treatment and rehabilitation programs even after mining operations cease.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-5.5	-11

7.5.4.7 Long Term Environmental Liabilities

Poor acid conditions can create long term environmental liabilities.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-5.5	-11

7.5.4.8 Limitations on Mine Site Water Reuse

Acid conditions can limit the reuse of mine site water and exacerbate the corrosion of site infrastructure and equipment

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-5.5	-11

7.5.5 REHABILITATION AND CLOSURE PHASE

7.5.5.1 Impact of AMD on Stream Ecology

Acid drainage can have extreme impacts on the ecology of streams, affecting the beneficial use of waterways downstream of mining operations

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5

Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.5.2 Mobilisation of Heavy Metals

Acid can mobilise (bring into solution) metals to levels injurious to aquatic ecosystems, riparian communities and possibly human health (e.g. zinc, cadmium, aluminium, copper)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.5.3 Limitations on Beneficial Downstream Water Uses

Acid can limit the downstream beneficial uses of the receiving water (e.g. stock, recreation, fishing, aquaculture, irrigation).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.5.4 Alteration of Water Chemistry Balance

Acid can alter important life supporting balances in water chemistry (e.g. bicarbonate buffering system).

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.5.5 Development of Chemical Precipitates

Acid can lead to the development of chemical precipitates (e.g. ferric hydroxide, aluminium hydroxide etc.) that can smother aquatic habitat and reduce light penetration

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.5.6 Development of Acid Conditions

Acid conditions can lead to the installation of expensive control, treatment and rehabilitation programs

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.5.7 Long Term Environmental Liabilities

Poor acid conditions can create long term environmental liabilities post mining.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.5.8 Limitations on Min Site Water Reuse

Acid conditions can limit the reuse of mine site water and exacerbate the corrosion of site infrastructure and equipment

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-18.75	-37.5
Alternative 3 (Sensitivity planning approach)	-18.75	-8.25	-16.5

7.5.6 ALTERNATIVE IMPACT DISCUSSION

A comparative assessment shows that the “No Go” option does not pose an impact. Both Alternative 2 and Alternative 3 pose a significant impact.

7.5.7 CONCLUSION

Despite the significance of the impact of both development Alternatives in terms of geochemistry, it is the opinion of the specialist that Alternative 3 will be easier to manage and is therefore preferred.

7.6 SOILS, LAND USE, AND LAND CAPABILITY

The following is a summary of the soils, land use, and land capability impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.6.1 PLANNING AND DESIGN PHASE

7.6.1.1 Loss of Soil Fertility

During the planning phase the loss of soil fertility will be minimal.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	1	1	1.16
Alternative 3 (Sensitivity planning approach)	1	1	1.16

7.6.1.2 Soil compaction

Loss of resource and soil utilisation potential may occur due to compaction over unprotected ground. Hoverer this impact is not likely to occur during the planning phase.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1.16
Alternative 3 (Sensitivity planning approach)	-1	-1	-1.16

7.6.1.3 Soil pollution/contamination

Loss of soil resource and utilisation potential may occur due to soil contamination by reagents and hydrocarbons spills and/or dirty water. During the planning phase however, this impact is unlikely to occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1.16
Alternative 3 (Sensitivity planning approach)	-1	-1	-1.16

7.6.1.4 Soil surface subsidence

If underground mining extraction techniques are not carried out correctly*, lack of support from underlying layers could cause the surface soil profile to vertically subside to a greater or lesser degree. This would cause problems for any future form of land use, whether forestry, cultivation or establishment of grass cover. However, during the planning phase, this is unlikely to occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1.16
Alternative 3 (Sensitivity planning approach)	-1	-1	-1.16

7.6.2 CONSTRUCTION PHASE

7.6.2.1 Loss of soil fertility

The reduction in natural soil fertility caused by removal, storage (stockpiling) and replacement of the soil profile. Aspects such as acidification, loss of nutrients and organic matter could apply. Such an impact is likely to increase the longer such conditions apply.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-10	-11.6
Alternative 3 (Sensitivity planning approach)	-7.5	-5.5	-6.41

7.6.2.2 Soil compaction

The loss of resource and soil utilisation potential may occur due to compaction over unprotected ground/soil particularly in working/laydown areas and storage facility areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5	-5	-5.83
Alternative 3 (Sensitivity planning approach)	-5.5	-5	-5.83

7.6.2.3 Soil pollution/contamination

If chemical changes in the soil occur due to the mining process, aspects such as acid mine drainage can occur, using the relatively porous soil material and underlying soil water as a medium of movement.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5.5	-5	-5.83

Alternative 3 (Sensitivity planning approach)	-5.5	-5	-5.83

7.6.2.4 Soil surface subsidence

If underground mining extraction techniques are not carried out correctly*, lack of support from underlying layers could cause the surface soil profile to vertically subside to a greater or lesser degree. This would cause problems for any future form of land use, whether forestry, cultivation or establishment of grass cover.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2.25	-4.5	-5.25
Alternative 3 (Sensitivity planning approach)	-2.25	-4.5	-5.25

7.6.3 OPERATION PHASE

7.6.3.1 Loss of soil fertility

Facilities constructed on site and operated from will sterilize the land therefore contributing to the loss of soil resource. This loss will be on-going for the duration of operation and beyond.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-12	-14
Alternative 3 (Sensitivity planning approach)	-8.25	-2.75	-3.20

7.6.3.2 Soil compaction

Soil compaction may potentially occur by the use of earthmoving machinery and other heavy vehicles on existing soil surface.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-8.25	-9.62
Alternative 3 (Sensitivity planning approach)	-8.25	-8.25	-9.62

7.6.3.3 Soil pollution/contamination

Contamination of the soils may occur by dirty water run-off and or spillage of hydrocarbons from vehicle and machinery (conveyancing systems, mechanical infrastructure and from storage facilities) or from dust and emissions from the processes underway.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-9	-5	-5.83
Alternative 3 (Sensitivity planning approach)	-9	-5	-5.83

7.6.3.4 Soil surface subsidence

During the operational phase the topography may be affected due to the mining activities. Surface subsidence may occur as a result.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-6	-4.5	-5.25

Alternative 3 (Sensitivity planning approach)	-6	-4.5	-5.25

7.6.4 DECOMMISSIONING PHASE

7.6.4.1 Loss of soil fertility

The loss of nutrients and organic potential may occur during the stockpiling of soil. This can potentially impact on the quality of the soil returned during rehabilitation. The stored soil is also susceptible to leaching of the unprotected materials.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-12	-14
Alternative 3 (Sensitivity planning approach)	-8.25	-5.5	-6.41

7.6.4.2 Soil compaction

There is the potential for soil compaction to occur during the decommissioning phase as a result of the machinery that will be o site removing operational phase infrastructure.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-8.25	-9.62
Alternative 3 (Sensitivity planning approach)	-11	-8.25	-9.62

7.6.4.3 Soil pollution/contamination

Contamination may occur of in-situ stored materials by dirty water outwashes and as a result of the use of dirty water for the irrigation of rehabilitated sites.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-9	-5	-5.83
Alternative 3 (Sensitivity planning approach)	-9	-5	-5.83

7.6.4.4 Soil surface subsidence

During the operational phase the topography may be affected due to the mining activities. Surface subsidence may occur as a result.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-6	-4.5	-5.25
Alternative 3 (Sensitivity planning approach)	-6	-4.5	-5.25

7.6.5 REHABILITATION AND CLOSURE PHASE

7.6.5.1 Loss of soil fertility

During the rehabilitation and closure phase soils are to be replaced and readied for regrowth of grasses. Fertilisers are likely to be introduced to the rehabilitated land which if done incorrectly can result in high levels of nutrification. The increase in additional compounds can potentially affect downstream environmental systems is surface runoff occurs or increased wind levels distribute soil in surface water features.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-12	-14
Alternative 3 (Sensitivity planning approach)	-8.25	5.5	-6.41

7.6.5.2 Soil compaction

The uncontrolled access to a rehabilitated site by animal, people and vehicles will potentially increase compaction and erosion due to the loss of vegetative cover (overgrazing etc.).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-8.25	-9.26
Alternative 3 (Sensitivity planning approach)	-11	-8.25	-9.62

7.6.5.3 Soil pollution/contamination

Soil pollution may potentially occur on site during the rehabilitation phase as a result of hydrocarbon/oil spills from trucks ad vehicles on site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-8.25	-5	-5.83
Alternative 3 (Sensitivity planning approach)	-8.25	-5	-5.83

7.6.5.4 Soil surface subsidence

Post mining activities may result in the change of topography. Soil subsidence can occur if the underground has not been incorrectly reinforced prior to the rehabilitation phase.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-6	-4.5	-5.25
Alternative 3 (Sensitivity planning approach)	-6	-4.5	-5.25

7.6.6 ALTERNATIVE IMPACT DISCUSSION

The "Maximum Mining" Alternative will have a significantly higher impact on the soils of the project area, due to the extra excavations connected to the extensive open-cast area (12.8 ha as opposed to around 0.3 ha for the "sensitivity planning" Alternative). In addition, since this area extends across the wetland to the south of the current "Sensitivity Planning" Alternative, there would be the added impact on the wetland soils, which would not only severely impact on the natural process (surface and sub-surface drainage, erosion control) on site, but potentially for a significant distance downstream due to the inevitable increase in sediment load and disturbance to the natural flow patterns.

7.6.7 CONCLUSION

As far as the soil aspects are concerned, the best Alternative will be the "No Go" Alternative, as no soil disturbance will take place, but if this is not possible, then the "Sensitivity Planning" Alternative is strongly recommended over the "Maximum Mining" Alternative.

7.7 FLORA IMPACTS

The following is a summary of the flora impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.7.1 PLANNING AND DESIGN PHASE

7.7.1.1 Invasive species encroachment

Disturbances to the site, including mining and construction activities, may result in an increase of invasive species on site and on downstream and adjacent properties. This impact is unlikely to occur during the planning phase.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-4.5	-4	-4.66
Alternative 3 (Sensitivity planning approach)	-4.5	-4	5.33

7.7.1.2 Erosion potential

Poor vegetation cover is present in the plantation areas and may lead to some erosion.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2	-2	-2.3
Alternative 3 (Sensitivity planning approach)	-2	-2	-2.6

7.7.1.3 Dust

Excessive dust may adversely affect vegetation growth, photosynthesis and respiration. Since vegetation will likely be removed in the mining and construction areas the area of impact is likely to be in a zone surrounding these activities and along the access roads to and from the site. The impact during the planning phase is however likely to be low.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7	-7	-7
Alternative 3 (Sensitivity planning approach)	-7	0	0

7.7.2 CONSTRUCTION PHASE

7.7.2.1 Removal of primary vegetation communities

It is expected that the plantation activities will not be extended in the area, since most of the available area is already in use. The only alternative where primary vegetation will be removed as part of the construction activities is therefore for Alternative 2, where mining will take place though the grass and sedge wetland vegetation unit. This will result in the removal of a portion of the primary vegetation on site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16.25	-12	-12
Alternative 3 (Sensitivity planning approach)	0	0	0

7.7.2.2 Removal of threatened and protected species

A few threatened species may potentially be present on site, but the species are most likely to occur in the primary grassland areas, especially in the south-western corner of the site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine	-5.5	-3.5	-3.5

production)			
Alternative 3 (Sensitivity planning approach)	0	0	0

7.7.2.3 Invasive species encroachment

Disturbances to the site, including mining and construction activities, may result in an increase of invasive species on site and on downstream and adjacent properties. Although there is a risk of invasive species encroachment at present, additional soil disturbances will result in an increase in invasive species encroachment. The risk of encroachment will remain until a sufficient cover of indigenous species is present over all rehabilitated areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11.25	-6.75	-7.87
Alternative 3 (Sensitivity planning approach)	-9.75	-6.75	-10.12

7.7.2.4 Erosion potential

Poor vegetation cover is present in the plantation areas and may lead to some erosion. Although some signs of erosion are visible in the plantation areas the erosion is limited. There is however a slight risk that the erosion will continue and may increase in severity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-7.5	-10
Alternative 3 (Sensitivity planning approach)	-9	-4.5	-6

7.7.2.5 Dust

Excessive dust may adversely affect vegetation growth, photosynthesis and respiration. Since vegetation will likely be removed in the mining and construction areas the area of impact is likely to be in a zone surrounding these activities and along the access roads to and from the site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-6.75	-7.87
Alternative 3 (Sensitivity planning approach)	-9	-6.75	-7.87

7.7.2.6 Pollution on vegetation

Several pollutants are associated with mining and construction activities including oil, concrete, coal dust, acid mine drainage etc. Most pollutants have the risk of killing plants or inhibiting plant growth and germination. Should a spill take place in a watercourse or close to a watercourse, the risk is greater and may potentially impact the vegetation downstream of the site as well

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16	-7.5	-8.75
Alternative 3 (Sensitivity planning approach)	-16	-7.5	-8.75

7.7.2.7 Altered hydrology and geohydrology

Mining alters the way water moves through the landscape, this affects the main vegetation driver of the remaining natural vegetation, which is predominantly wetland vegetation, as well as a very important driver of all the other vegetation communities.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16	-9	10.5
Alternative 3 (Sensitivity planning approach)	-7.5	-6	-7

7.7.2.8 Vegetation diversity

The vegetation diversity may be impacted on during the operational phase.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-7.5	-7.5
Alternative 3 (Sensitivity planning approach)	0	0	0

7.7.3 OPERATION PHASE

7.7.3.1 Invasive species encroachment

Disturbances to the site, including mining and construction activities, may result in an increase of invasive species on site and on downstream and adjacent properties.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-6.75	-7.87

Alternative 3 (Sensitivity planning approach)	-14	-6.75	-10.12

7.7.3.2 Erosion potential

Poor vegetation cover is present in the plantation areas and may lead to some erosion

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-7.5	-10
Alternative 3 (Sensitivity planning approach)	-6	-4.5	-6

7.7.3.3 Dust

Excessive dust may adversely affect vegetation growth, photosynthesis and respiration. The operational phase will see an increase in the effect of dust on flora.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-9	-10.5
Alternative 3 (Sensitivity planning approach)	-13	-9	-10.5

7.7.3.4 Pollution on vegetation

Several pollutants are associated with mining and construction activities including oil, concrete, coal dust, acid mine drainage etc. Most pollutants have the risk of killing plants or inhibiting plant growth and germination. Should a spill take place in a watercourse or close to a watercourse, the risk is greater and may potentially impact the vegetation downstream of the site as well

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16	-7.5	-8.75
Alternative 3 (Sensitivity planning approach)	-16	-7.5	-8.75

7.7.3.5 Altered hydrology and geohydrology

The development will likely change the geohydrology and hydrology of the local catchment significantly, these impacts will have an impact on the wetland vegetation, through the disruption of water movement through the soil strata, as well as altering the potential connectivity between the soil and geology, especially under watercourses.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16	-9	-10.5
Alternative 3 (Sensitivity planning approach)	-7.5	-6	-7

7.7.4 DECOMMISSIONING PHASE

7.7.4.1 Invasive species encroachment

Disturbances to the site, including mining and construction activities, may result in an increase of invasive species on site and on downstream and adjacent properties.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	-15	-6.75	-7.87
Alternative 3 (Sensitivity planning approach)	-14	-6.75	-9

7.7.4.2 Erosion potential

Poor vegetation cover is present in the plantation areas and may lead to some erosion

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-7.5	-10
Alternative 3 (Sensitivity planning approach)	-6	-4.5	-6

7.7.4.3 Dust

Excessive dust may adversely affect vegetation growth, photosynthesis and respiration. The operational phase will see an increase in the effect of dust on flora.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-9	-10.5
Alternative 3 (Sensitivity planning approach)	-13	-9	-10.5

7.7.4.4 Pollution on vegetation

Several pollutants are associated with mining and construction activities including oil, concrete, coal dust, acid mine drainage etc. Most pollutants have the risk of killing plants or inhibiting plant growth and germination. Should a spill take place in a watercourse or close to a watercourse, the risk is greater and may potentially impact the vegetation downstream of the site as well.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16	-7.5	-8.75
Alternative 3 (Sensitivity planning approach)	-16	-7.5	-8.75

7.7.4.5 Altered hydrology and geohydrology

Mining alters the way water moves through the landscape, this affects the main vegetation driver of the remaining natural vegetation, which is predominantly wetland vegetation, as well as a very important driver of all the other vegetation communities. This is impossible to prevent, and mitigation is relatively complex.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16	-9	-10.5
Alternative 3 (Sensitivity planning approach)	-7.5	-6	-7

7.7.5 REHABILITATION AND CLOSURE PHASE

7.7.5.1 Invasive species encroachment

Disturbances to the site, including mining and construction activities, may result in an increase of invasive species on site and on downstream and adjacent properties.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-4.5	-4.5	-5.25
Alternative 3 (Sensitivity planning approach)	-14	-6.75	7.87

7.7.5.2 Erosion potential

Poor vegetation cover is present in the plantation areas and may lead to some erosion

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-6	-6.75	-7.87
Alternative 3 (Sensitivity planning approach)	-6	-4.5	-6

7.7.5.3 Dust

Excessive dust may adversely affect vegetation growth, photosynthesis and respiration. Since vegetation will likely be removed in the mining and construction areas the area of impact is likely to be in a zone surrounding these activities and along the access roads to and from the site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	0	0	0
Alternative 3 (Sensitivity planning approach)	0	0	0

7.7.5.4 Vegetation diversity

During the rehabilitation phase the disturbed areas are vegetated, normally to a similar condition than prior to disturbance. If a soil cover is in place on the rehabilitated open cast section, trees will have a negative impact on the functioning of the soil cover, and it must be rehabilitated to a grass cover. Should plantation areas however be reinstated to good quality secondary grassland areas, the overall impact on vegetation diversity would be a neutral or positive impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-6	-8.25	-8.25
Alternative 3 (Sensitivity planning approach)	0	0	0

7.7.6 ALTERNATIVE IMPACT DISCUSSION

The proposed area for the mining activities is mostly covered by forestry plantation, or with cleared plantation forestry. Only a few substantially negative impacts in terms of the Vegetation and Flora biodiversity are therefore anticipated in this area. The extended open cast mining area proposed in Alternative 2 does however cross a wetland area with primary vegetation dominated by grass and sedge species. More impacts are therefore anticipated for Alternative 2 than Alternative 3. Mitigation measures are proposed to limit the impact of the mining activities on the vegetation.

7.7.7 CONCLUSION

Alternative 3 is the preferred Alternative from a vegetation perspective.

7.8 FAUNA IMPACTS

The following is a summary of the Faunal impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.8.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.8.2 CONSTRUCTION PHASE

7.8.2.1 Loss or fragmentation of habitat for threatened animals

Any destruction of habitat will lead to the fragmentation of habitat that affects remaining habitats on site as well as off-site habitats. Habitat fragmentation occurs when large, continuous areas of habitat is both reduced in area and divided into two or more fragments or habitat. Habitat fragmentation is a concern because of its potential to isolate populations and reduce biodiversity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-17.5	-17.5
Alternative 3 (Sensitivity planning approach)	-5.5	-5.5	-5.5

7.8.2.2 Loss of individuals of animal species of concern

Key habitat for faunal species on site is lowlands with water bodies, wetlands or marshy areas, as well as any adjacent grassland areas. Plantation forests can also support populations of sensitive species, especially small raptors. The mining activities have the potential to frighten these species forcing them to move off site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-3.25	-2	-2
Alternative 3 (Sensitivity planning approach)	-2.75	-1.75	-1.75

7.8.2.3 Displacement of mobile fauna

The destruction of habitats on site and the general presence of mining activity on site will lead to populations of fauna moving away or being negatively affected while on site. This will be proportionate to the magnitude of the proposed mining operation. Alternative 3 has the highest negative impact for the construction phase.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2.75	-2.75	-2.75
Alternative 3 (Sensitivity planning approach)	-2.5	-2.5	-2.5

7.8.3 OPERATION PHASE

7.8.3.1 Degradation of habitat

The pollution of habitats includes the impact on water quality and quantity, pollution of aquatic habitat and air quality. The impacts from mining on water can also include effects on riverine and wetland environments, depending on the location of the mine. Negative air quality effects can occur from processing plants, crushers and chemical/hydrocarbon by-product release in to the air.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5.5	-4	-4
Alternative 3 (Sensitivity planning approach)	-2.75	-2	-2

7.8.3.2 Loss of individuals of animal species of concern

Key habitat for faunal species on site is lowlands with water bodies, wetlands or marshy areas, as well as any adjacent grassland areas. Plantation forests can also support populations of sensitive species, especially small raptors. The mining activities have the potential to frighten these species forcing them to move off site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2.25	0	0
Alternative 3 (Sensitivity planning approach)	-2.75	0	0

7.8.4 DECOMMISSIONING PHASE

No impacts have been identified for this phase.

7.8.5 REHABILITATION AND CLOSURE PHASE

7.8.5.1 Creation of new habitats

The rehabilitation of the mining footprint can lead to positive impacts namely the creation of new habitats in the place of the coal mining infrastructure. The new habitats will be secondary in nature and will not have the characteristics of any natural habitats. However, over time the vegetation will recover and offer grassland like ecosystem.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	6	-6	-6
Alternative 3 (Sensitivity planning approach)	6	-6	-6

7.8.6 ALTERNATIVE IMPACT DISCUSSION

Habitat potentially affected by mining is either not in a natural state (plantation forestry) or is of low importance for faunal species of concern. Mining on site could potentially have impacts on various species of conservation concern, specifically birds. However, key habitat is any natural habitat on site, most of which will not be affected by the proposed mining. The risk to species of concern from either development Alternative is therefore minimal.

7.8.7 CONCLUSION

Either mining option is acceptable, but Alternative 3 (Sensitivity Planning Approach) is preferred due to the lower significance of potential impacts.

7.9 SURFACE WATER IMPACTS

The following is a summary of the surface hydrology impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.9.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.9.2 CONSTRUCTION PHASE

7.9.2.1 Erosion

During the construction phase, vegetation will be removed for the development of the infrastructure. The removal of this vegetation cover may potentially lead to erosion occurring on site by both wind and rain.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-20	-12	-14
Alternative 3 (Sensitivity planning approach)	-20	-4	-5.33

7.9.2.2 Surface water contamination

During the construction phase surface water environments are susceptible to becoming polluted. These systems can become polluted as a result of poorly designed wash bays, related water facilities on site and hydrocarbon spills from heavy machinery and vehicles onsite.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	18.75	-11	-11
Alternative 3 (Sensitivity planning approach)	-9	-4.5	-4.5

7.9.2.3 Deterioration of river banks

The constructing conveyors and roads across rivers could result in the loosening of ground and therefore the deterioration of the river banks causing them to collapse.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17	-7.5	-8.75
Alternative 3 (Sensitivity planning approach)	-9.75	-5.5	-6.41

7.9.2.4 Loss of vegetative cover

Vegetation is to be removed during the construction process to make way for operation facilities and further infrastructure. The loss of vegetation can lead to poor infiltration and increased surface runoff.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13.75	-5	-6.66
Alternative 3 (Sensitivity planning approach)	0	0	0

7.9.2.5 Stream flow reduction

Due to the construction of water-retaining infrastructure upstream, storm water trapped in the early stages of rainfall will affect the runoff that generates stream flow.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-7.5	-11.25
Alternative 3 (Sensitivity planning approach)	-7.5	-4.5	-6.75

7.9.2.6 Soil compaction

Soil compaction can potentially occur on site as a result of heavy machines utilizing dirt roads. During the construction of the mine infrastructure the surrounding facilities footprint may also become compacted. This intensive soil compaction has the ability to cause server surface run off leading to erosion, sediment transportation, siltation and pollution of surface water systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	8.25	5	6.66
Alternative 3 (Sensitivity planning approach)	9	7.5	10

7.9.2.7 Sediment runoff and increased suspended solids

Siltation of the surface water resources may occur if there is surface water runoff on site. Increases in uncontrolled runoff will lead to increased siltation being deposited downstream.

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-20	-4.5	-6
Alternative 3 (Sensitivity planning approach)	-15	-4.5	-6

7.9.2.8 Altered drainage pattern

If the topography is affected by construction, the drainage pattern can become altered.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11.25	-3	-3
Alternative 3 (Sensitivity planning approach)	-9	-3	-3

7.9.3 OPERATION PHASE

7.9.3.1 Erosion

Due to the substantial infrastructure footprint of a mine, soil erosion is possible due to removal of vegetation at the site. Erosion has the potential to increase during the operational phase as there are more activities occurring on site with increased vegetation loss and longer exposure to Aeolian and other forms of surface erosion.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-20	-12	-14

Alternative 3 (Sensitivity planning approach)	-18.75	-6.75	-9

7.9.3.2 Surface water contamination

During the operational phase surface water environments are susceptible to becoming polluted. These systems can become polluted as a result of poorly designed wash bays, related water facilities on site and hydrocarbon spills from heavy machinery, conveyors and vehicles onsite

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-7.5	-8.75
Alternative 3 (Sensitivity planning approach)	-7.5	-7.5	-8.75

7.9.3.3 Deterioration of river banks

Constructing conveyors and roads across rivers could result in the loosening of ground and therefore the deterioration of the river banks.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-10	-13,.33
Alternative 3 (Sensitivity planning approach)	-9	-5	-6.66

7.9.3.4 Stream flow reduction

Due to the construction of water-retaining infrastructure upstream, storm water trapped in the early stages of rainfall will affect the runoff that generates stream flow.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-11	-14.66
Alternative 3 (Sensitivity planning approach)	-9	-5.5	-7.33

7.9.3.5 Soil compaction

Soil compaction can potentially occur on site as a result of heavy machines utilizing dirt roads. During the operational phase of the mine, the surrounding facilities footprint may also become compacted. This intensive soil compaction has the ability to cause severe surface run off leading to erosion, sediment transportation, siltation and pollution of surface water systems. Soil compaction is considered to be a positive impact due to the potential to reduce surface water infiltration and contamination.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	7.5	7.5	8.75
Alternative 3 (Sensitivity planning approach)	9	4	4.6

7.9.3.6 Sediment runoff and increased suspended solids

Siltation of the surface water resources may occur if there is surface water runoff on site. Increases in uncontrolled runoff will lead to increased siltation being deposited downstream.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	-14	-6.75	-9
Alternative 3 (Sensitivity planning approach)	-6.5	-6.75	-9

7.9.3.7 Altered drainage pattern

If the topography is affected by construction, the drainage pattern can become altered.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16.25	-4.5	-5.25
Alternative 3 (Sensitivity planning approach)	-16.25	-4.5	-5.25

7.9.4 DECOMMISSIONING PHASE

7.9.4.1 Erosion

Vegetation clearance from the construction phase together with the soil compaction as a result of the construction/operation phases and the decommissioning of the mine structures would result in the disturbed area becoming highly susceptible to surface runoff. Increase surface run off would further impact on erosion and increase sedimentation downstream.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-14	-14
Alternative 3 (Sensitivity planning approach)	-17.5	-4	-5.33

7.9.4.2 Surface water contamination

During the decommissioning phase surface water environments are susceptible to becoming polluted whilst waste products are being removed from the site or caped. Smaller potential polluting methods like poorly designed wash bays, related water facilities on site and hydrocarbon spills from heavy machinery and vehicles onsite may contribute to surface water contamination.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-9.75	-11.37
Alternative 3 (Sensitivity planning approach)	-13	-9	-10.5

7.9.4.3 Deterioration of river banks

Continuous use of conveyors and roads across rivers could result in the loosening of ground and therefore the deterioration of the river banks.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-8.25	-9.62
Alternative 3 (Sensitivity planning approach)	-16	-5	-5.8

7.9.4.4 Stream flow reduction

Due to the construction of water-retaining infrastructure upstream, storm water trapped in the early stages of rainfall will affect the runoff that generates stream flow.

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-9.75	-14
Alternative 3 (Sensitivity planning approach)	-9	-5.5	-7.33

7.9.4.5 Soil compaction

Soil compaction can potentially occur on site as a result of heavy machines utilizing dirt roads on a regular basis. During the decommissioning phase of the mine, soil compaction can potentially increase due to the increased traffic on site with heavy machines removing discarded waste, overburden and soil. This intensive soil compaction has the ability to cause server surface run off leading to erosion, sediment transportation, siltation and pollution of surface water systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	6.75	6	8
Alternative 3 (Sensitivity planning approach)	8.25	5	6.6

7.9.4.6 Sediment runoff and increased suspended solids

Siltation of the surface water resources may occur if there is surface water runoff on site. Increases in uncontrolled runoff will lead to increased siltation being deposited downstream

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16	-5	-7.5

Alternative 3 (Sensitivity planning approach)	-9.75	-5	-7.5

7.9.4.7 Altered drainage pattern

During decommissioning the topography of the site will potentially be affected by the removal of infrastructure, stockpiles and waste rock dumps. Any open mining areas (Adit) or open cast sections will be prepared for filling by the overburden and stockpile of soil.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5.5	-3	-4
Alternative 3 (Sensitivity planning approach)	-5	-3	-4

7.9.5 REHABILITATION AND CLOSURE PHASE

7.9.5.1 Erosion

During the rehabilitation process, soil is to be placed back where it was removed from and compacted soil is to be ripped and loosened. As a result of the loose soil before re-vegetation has the opportunity to take effect sediment may be transported off-site due to heavy rains in summer or by wind during the windy months.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-9.75	-13
Alternative 3 (Sensitivity planning approach)	-16.25	-6	-8

7.9.5.2 Surface water contamination

During the rehabilitation phase surface water environments are susceptible to becoming polluted whilst waste products are being removed from the site or caped. Smaller potential pollutants like PCD's on site and hydrocarbon spills from vehicles onsite may contribute to surface water contamination.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10.5	-9.75	-11.37
Alternative 3 (Sensitivity planning approach)	-9.75	-9	-10.5

7.9.5.3 Stream flow reduction

Due to the construction of water-retaining infrastructure upstream, storm water trapped in the early stages of rainfall will affect the runoff that generates stream flow.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-6.5	-9.75
Alternative 3 (Sensitivity planning approach)	-10	-5.5	-8.25

7.9.5.4 Soil compaction

As the activity on site decreases soil compaction will decrease respectively. However soil compaction will still exist as a result of the heavy machinery present during decommissioning.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	8.25	5	8.3
Alternative 3 (Sensitivity planning approach)	9.75	-6.75	-11.25

7.9.5.5 Sediment runoff and increased suspended solids

Siltation of the surface water resources may occur if there is surface water runoff on site. Increases in uncontrolled runoff will lead to increased siltation being deposited downstream.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-6	-10
Alternative 3 (Sensitivity planning approach)	-14	-6	-10

7.9.5.6 Altered drainage pattern

Post mining will see rehabilitation efforts to return the topography back to its pre mining condition. However, this is unlikely to be full achieved due to the disturbance caused by mining activities.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16.25	-4	-5.3
Alternative 3 (Sensitivity planning approach)	-6.5	-4	-5.3

7.9.6 ALTERNATIVE IMPACT DISCUSSION

Alternative 2 will result in the direct loss of just over 1.72 hectares of wetland habitat, including a small farm dam, a section of valley bottom wetland and a section of hillslope seepage wetland, whereas neither Alternative 1 or Alternative 3 will result in the direct disturbance of surface water features.

7.9.7 CONCLUSION

Based on the environmental significance of each of the proposed Alternative as well as their impact prioritisation it was concluded that Alternative 3 has less impact on the environment compared to the other two alternatives. This is mainly due to the fact that Alternative 3 has a lesser extent than Alternative 2.

7.10 WETLAND IMPACTS

The following is a summary of the wetland impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.10.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.10.2 CONSTRUCTION PHASE

7.10.2.1 Loss and disturbance of wetland habitat

The loss or disturbance of wetland habitat in this instance is as a result of the proposed placement of the opencast area. This would potentially result in the displacement of wetland fauna and additional disturbances such as potential fires, increased erosion and materials being placed within the wetland (stockpiles).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-1	-1.5
Alternative 3 (Sensitivity planning approach)	0	0	0

7.10.2.2 Increased sediment transport into wetlands

Increased sediment into the wetlands is as a result of vegetation stripping which often increases surface runoff, increased erosion with downstream receiving wetlands. Heavy machinery and mining activities often cause soil compaction further increasing surface runoff. The sediment that has been transported into the wetlands as a result of these activities is likely to be colonized by pioneer and ruderal species which will impact on the overall habitat quality.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-5.25	-5.25
Alternative 3 (Sensitivity planning approach)	-8	-3.5	-4.08

7.10.2.3 Water quality deterioration

During the construction phase, as activities are taking place in close proximity to wetlands, there is a possibility that water quality can be impaired. Water quality may be impacted on during the construction phase by accidental spillages and the intentional washing and rinsing of equipment within the wetlands. It is likely that hydrocarbons will be stored and used on site, as well as cement and other potential pollutants.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-6	-7
Alternative 3 (Sensitivity planning approach)	-6	-3.5	-4.66

7.10.2.4 Decreased watermake to adjacent wetlands

The construction of the shaft and associated surface infrastructure will result in decreased watermake (available water) to adjacent wetlands. The shaft excavations are likely to cause the drawdown of the water table, potentially impacting on the flow to other wetlands.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13.75	-12.5	-14.58
Alternative 3 (Sensitivity planning approach)	-13.75	-12.5	-14.58

7.10.3 OPERATION PHASE

7.10.3.1 Loss and disturbance of wetland habitat

The loss or disturbance of wetland habitat in this instance is as a result of the proposed placement of the mining shaft. This would potentially result in the displacement of wetland fauna and additional disturbances such as potential fires, increased erosion and materials being placed within the wetland (stockpiles).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16.25	-7.5	-11.25
Alternative 3 (Sensitivity planning approach)	0	0	0

7.10.3.2 Increased sediment transport into wetlands

Increased sediment into the wetlands is as a result of vegetation stripping which often increases surface runoff, increased erosion with downstream receiving wetlands. Machinery and mining activities often cause soil compaction further increasing surface runoff. The sediment that has been transported into the wetlands as a result of these activities is likely to be colonized by pioneer and ruderal species which will impact on the overall habitat quality.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-11	-8
Alternative 3 (Sensitivity planning approach)	-8	-3.5	-4.08

7.10.3.3 Water quality deterioration

During the operational phase, as activities are taking place in close proximity to wetlands, there is a possibility that water quality can be impaired. Water quality may be impacted on during the operational phase by accidental spillages and the intentional washing and rinsing of equipment within the wetlands. It is likely that hydrocarbons will be stored and used on site, as well as cement and other potential pollutants.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-6	-7
Alternative 3 (Sensitivity planning approach)	-7.5	-6	-8

7.10.3.4 Decreased watermake to adjacent wetlands

The construction of the shaft and associated surface infrastructure will result in decreased watermake to adjacent wetlands. The shaft excavations are likely to cause the drawdown of the water table, potentially impacting on the flow to other wetlands.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-12.5	-14.58
Alternative 3 (Sensitivity planning approach)	-13.75	-11.25	-13.25

7.10.3.5 Discharge of stormwater into wetlands

Impermeable surfaces as a result of compacted soils (road surfaces) will result in increased runoff. The storm water will be collected in the storm water management system conveyed to the valley bottoms. This will result in point source discharge therefore increasing erosion and increased pollutants.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-8	-9.33
Alternative 3 (Sensitivity planning approach)	-9	-6	-8

7.10.3.6 Undermining of wetlands - surface subsidence

7.63 hectares of wetlands and watercourses are likely to be undermined, consisting of mostly hillslope seepage wetlands and small channelled valley bottom wetlands in the extreme upper reaches of both the Hlelo and Ngwempisi river systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-3.25	-4.33
Alternative 3 (Sensitivity planning	-7.5	-3.25	-4.33

approach)			

7.10.4 DECOMMISSIONING PHASE

7.10.4.1 Increased alien vegetation cover

Recently placed and disturbed soils are susceptible to invasion by alien vegetation, e.g. *Acacia mearnsii* (black wattle). These alien species could spread to the adjacent wetland areas and result in decreased flows, increased erosion and decreased biodiversity in these systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-9	-5.25	-5.25
Alternative 3 (Sensitivity planning approach)	-9	-5.25	-5.25

7.10.4.2 Water quality deterioration

Decommissioning activities involve the removal of dirty water areas and associated dirty water management systems such as PCD's. These facilities have the ability to result in the mobilisation of pollutants trapped in the soils underlying the facilities areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-6	-8
Alternative 3 (Sensitivity planning approach)	-7.5	-6	-8

7.10.4.3 Increased sediment transport into wetlands

During the decommissioning phase, the utilised areas will be susceptible to erosion during and following rehabilitation, especially in areas that are sparsely vegetated or not vegetated at all. This will result in increased sediment loads in the downslope wetlands, leading to deteriorating water quality.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-9	-5.25	-6.12
Alternative 3 (Sensitivity planning approach)	-6	-5.25	-6.12

7.10.5 REHABILITATION AND CLOSURE PHASE

7.10.5.1 Increased sediment transport into wetlands

Increased sediment into the wetlands is as a result of vegetation stripping which often increases surface runoff, increased erosion with downstream receiving wetlands. Machinery and mining activities often cause soil compaction further increasing surface runoff. The sediment that has been transported into the wetlands as a result of these activities is likely to be colonized by pioneer and ruderal species which will impact on the overall habitat quality.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-5.25	-5.25
Alternative 3 (Sensitivity planning approach)	-8	-3.5	-4.08

7.10.5.2 Altered hydrology

Alternative 3 will see the least damage seen to the wetland area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-14	-15.16
Alternative 3 (Sensitivity planning approach)	-10	-7.5	-10

7.10.5.3 Water quality deterioration

Rehabilitation activities involve the removal of dirty water areas and associated dirty water management systems such as PCD's. These facilities have the ability to result in the mobilisation of pollutants trapped in the soils underlying the facilities areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-10	-13.33
Alternative 3 (Sensitivity planning approach)	-21.25	-10	-13.33

7.10.5.4 Surface subsidence

Post-closure, failure of pillars could lead to surface subsidence. (See previous sections on the impact of subsidence), however the impact significance of his impact occurring is considered Low.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-3.5	-4.08
Alternative 3 (Sensitivity planning approach)	-7.5	-3.5	-4.66

7.10.6 ALTERNATIVE IMPACT DISCUSSION

Alternative 1 represents the areas status quo and will see no mining activities occur, thus there is no impact that exists in this scenario. Alternative 2 proposes to mine the coal reserves on site predominantly using only underground mining methods, but significantly includes an opencast pit that extends right across the central valley bottom wetland system and will thus require a stream diversion. All wetland habitat falling within the direct footprint of the opencast pit and the shaft infrastructure is expected to be permanently destroyed. In total, Alternative 2 will result in the direct loss of just over 1.72 hectares of wetland habitat, including a small farm dam, a section of valley bottom wetland and a section of hillslope seepage wetland. Underground mining associated with Alternative 3 proposes to mine the coal reserves on site predominantly using only underground mining methods, but also includes a small opencast pit that extends to within 100m of the delineated wetland boundary, but does not directly significantly impact on any wetland habitat. No direct wetland loss is expected as a result of Alternative 3. The underground mining associated with Alternative 2 and 3 will result in the undermining of 7.63 hectares of wetland habitat respectively.

7.10.7 CONCLUSION

The key differences between Alternatives 2 and 3 is the size of the opencast pit, and the fact that under the Alternative 2 scenario, the proposed opencast pit extends right across the central wetland system and will thus likely require a stream diversion. The location and extent of underground mining and associated surface infrastructure is the same for both mining Alternatives.

From a wetland perspective, the ranking of Alternatives from most preferred to least preferred is as follows:

- Alternative 1 – the No-go option
- Alternative 3 – small opencast, no direct wetland impact
- Alternative 2 – larger opencast, direct wetland impact and likely stream diversion required

Amongst the two mining Alternatives, the key differences with regards to impact on wetlands relates to the extent of the opencast pit and the direct impact on wetland habitat. Alternative 2 is the only Alternative where a direct impact to wetland habitat is expected, with over 1.7 ha likely to be permanently lost. Opencast mining permanently alters the way water behaves in the landscape. Not only will all wetlands within the direct footprint of the opencast pits be lost, but the processes and controls leading to wetland formation will be altered to the degree that no wetlands are likely to reform on the rehabilitated opencast areas. Adjacent wetlands upstream and downstream will also be impacted as a stream diversion will likely be required to convey flows from upstream around the opencast pit. As such, Alternative 2 is considered the least favourable option from a wetland perspective. If mining is to proceed on site, then

Alternative 3 is considered the preferred alternative, as no direct wetland loss will occur and no stream diversion would be required.

7.11 AQUATIC ECOLOGY IMPACTS

The following is a summary of the aquatic ecology impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.11.1 PLANNING AND DESIGN PHASE

7.11.1.1 Increased sedimentation at wetland crossings

The dust generated at wetland crossings is likely to settle out on stream beds, rendering benthic habitats less suitable to aquatic biota.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-3.75	-3.75	-3.75
Alternative 3 (Sensitivity planning approach)	-3.75	-3.75	-3.75

7.11.2 CONSTRUCTION PHASE

7.11.2.1 Sedimentation (vegetation clearance, road crossings)

Clearing of vegetation, soil disturbance and erosion of soil stockpiles and along stormwater channels leads to increased erosion (especially during wet season) and increased dust that may enter the receiving water body. The construction of the road crossing over the Ngwempisi River for the transport of coal to Delta Plant will potentially contribute a significant amount of sediments to the Ngwempisi River. This can increased turbidity thereby negatively impacting on certain aquatic fauna.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-15	-15
Alternative 3 (Sensitivity planning approach)	-12	-11	-11

7.11.2.2 Erosion at river crossings (haul road)

The current status quo of the crossing over the Ngwempisi River is badly eroded. Plans to build a second bridge will exacerbate the existing erosion. The construction of coffer dams during construction will also affect flows downstream, possibly affecting flow sensitive aquatic species.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-17.5	-20.47
Alternative 3 (Sensitivity planning approach)	-17.5	-17.5	-20.47

7.11.2.3 Flow modification

Vegetation removal and the construction of hard surfaces will decrease infiltration of surface water and result in great volumes of storm water runoff from the construction site. This, in turn, will exacerbate erosion and sedimentation (as discussed above). Increased flows in receiving watercourses may affect species composition and may compromise habitat availability for species with a preference for slow flowing pool habitats.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-18.75	-15	-15

Alternative 3 (Sensitivity planning approach)	-11	-10	-10

7.11.2.4 Erosion of banks

Increased flows (both in terms of volume and velocity) will result in increased erosion of beds (incision of the channel) and banks. Decreased flows, on the other hand, will cause greater exposure of river banks to erosion and also to invasion by alien vegetation. Erosion of banks, as well as channel incision, will result in decreased habitat availability for species associated with marginal vegetation habitats. Scouring of stream beds will result in the loss of species with a preference for cobbled or gravel substrates.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-13	-15.21
Alternative 3 (Sensitivity planning approach)	-16.25	-11	-12.87

7.11.2.5 Water quality

The water quality within the study area is considered good, which renders the receiving watercourses, together with the aquatic biota associated with them, highly sensitive to water quality deterioration. The current status quo may potentially be impacted on in the following ways, the mobilisation of sediments into the water body, hydrocarbon spills the make their way into the water bodies, stormwater runoff from the construction site into the waterbody and hazardous waste seeping out of the PCD.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16.25	-15	-17.55
Alternative 3 (Sensitivity planning	-12	-7.5	-8.77

approach)			

7.11.2.6 Spread of alien fish species

Alien fish species are often spread through the introduction of people to an area. The introduction of alien species is most often for angling/recreational purposes, but can also be driven by subsistence needs for protein. Alien fish species compete with indigenous fish species for habitat and food, and can have a devastating impact on natural aquatic biota through predation and habitat destruction.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-12	-7.5	-8.77
Alternative 3 (Sensitivity planning approach)	-12	-7.5	-8.77

7.11.2.7 Alien invasive vegetation

Soil that has been disturbed as a result of construction, as well as soil stockpiles, is likely to be colonised by alien vegetation. These alien plants provide seeds that are dispersed in wind and water into adjacent wetland areas. Of major concern is Black Wattle (*Acacia mearnsii*) which invades river banks in high densities, thus shading out other marginal and riparian plants. This results in stream banks that are bare and exposed to erosion. There is also an absence of overhanging and marginal vegetation that would otherwise serve as habitat for many aquatic animals.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-7.5	-8.77
Alternative 3 (Sensitivity planning approach)	-13	-7.5	-8.77

7.11.2.8 Loss of wetland areas

This impact only applies to Alternative 2 where the footprint extends across a wetland. There will be no road crossings of wetlands for either Alternative.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-16.25	-16.25	-21.61
Alternative 3 (Sensitivity planning approach)	0	0	0

7.11.2.9 Loss of sensitive species

All the impacts discussed above may contribute to deterioration in aquatic habitats, stream flow and water quality. Habitats may be affected by sedimentation, turbidity, erosion and/or alien vegetation.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-5.5	-7.31
Alternative 3 (Sensitivity planning approach)	-8.25	-5.5	-7.31

7.11.3 OPERATION PHASE

7.11.3.1 Water Quality - coal dust from blasting, stockpiles, conveyors, coal trucks and roads

Coal and coal dust from stockpiles, blasting, conveyors, coal trucks, roads and bridge crossings may be flushed and/or blown into the surface waters. This can potentially lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-13	-19.5
Alternative 3 (Sensitivity planning approach)	-14	-13	-19.5

7.11.3.2 Acidification of surface water - Seepage and AMD

Where surface water seeps into groundwater, acid mine drainage can occur with acidification and salinisation of groundwater which may then emerge in watercourses. This may potentially occur in shallow open-cast or underground mining or from product and/or waste stockpiles.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-23.75	-23.75	-43.46
Alternative 3 (Sensitivity planning approach)	-22.5	-21.25	-38.88

7.11.3.3 Water Quality impacts due to spills/leaks, stormwater

The risk to receiving watercourses during the operational phase is that water quality will decline as a result of leaking pipelines carrying dirty water from underground and open-cast workings. Further risks are posed by leaking or overflowing pollution control facilities and stormwater drains. This will result in the salinization and acidification of surface water which can pose a toxic risk to sensitive aquatic biota. Saline conditions also encourage the proliferation of filamentous algae that, in turn, render substrate habitats unsuitable for aquatic invertebrates and certain fish.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-21.25	-35.48
Alternative 3 (Sensitivity planning approach)	21.25	-16	-26.72

7.11.3.4 Deterioration in water quality and habitats - solid waste and hazardous waste

Inappropriately stored solid and hazardous waste, including PVC piping, fluorescent lights and oils and greases can produce leachate that can seep into soils or be washed into waterbodies in stormwater runoff. This can cause the loss of sensitive aquatic species and a decline in habitats and ecological integrity within receiving watercourses.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-7.5	-8.77
Alternative 3 (Sensitivity planning approach)	-15	-7.5	-8.77

7.11.3.5 Water quality impacts due to runoff and erosion

Storm water runoff may contain coal dust, contaminated mine water, sewage treatment effluent, spills (especially oils and fuels in workshops & stores) which could lead to pollution of freshwater ecosystems, with a consequent loss of biota or integrity. Stormwater generally also contains high levels of sediment which affect the clarity (turbidity) of receiving watercourses.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-21.25	-31.87

Alternative 3 (Sensitivity planning approach)	-15	-7.5	-8.77

7.11.3.6 Water quality and habitat impacts due to coal transport to Delta

Mined coal will be transported via road to Delta Processing Plant, Ermelo. The route will cross a number of wetlands and the following watercourses: Hlelo Tributary, Ngwempisi River (both within the Leiden study area), the Sandspruit (a tributary of the Ngwempisi River), the Vaal River and the Witpuntspruit (a tributary of the Vaal River). As such, the potential for contamination of water resources by coal dust is spread across a wide area (three quaternary catchments).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-14	-16.38
Alternative 3 (Sensitivity planning approach)	-14	-14	-16.38

7.11.3.7 Water quality impacts due to major spills (e.g. fuel, sewage)

Mined coal will be transported via road to Delta Processing Plant, Ermelo. The route will cross a number of wetlands and the following watercourses: Hlelo Tributary, Ngwempisi River (both within the Leiden study area), the Sandspruit (a tributary of the Ngwempisi River), the Vaal River and the Witpuntspruit (a tributary of the Vaal River). As such, the potential for contamination of water resources by coal dust is spread across a wide area (three quaternary catchments).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-19	-17	-28.39
Alternative 3 (Sensitivity planning	-14.25	-8.5	14.19

approach)			

7.11.3.8 Flow modification - Subsidence and open-cast mining

Undermining of wetlands could result in wetland loss and degradation where surface subsidence occurs. Fractures in the strata underlying the wetlands could result in loss of surface water to groundwater, leading to decreased base flows, desiccation of wetlands and changes in species composition.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	22.5	-18	-30.06
Alternative 3 (Sensitivity planning approach)	-12.75	-8	13.36

7.11.3.9 Erosion and flow modifications due to increased stormwater

All impacts with regard to increased storm water flows mentioned during the construction phase, apply equally to the operational phase. Water will be diverted around the infrastructure and open-cast operations and subsequently discharged back into receiving wetlands, this resulting in accelerated flows and point source discharges. Any road crossing constructed over wetlands will cause constrictions, with accelerated flows around the constrictions. This will cause erosion at road crossings.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-20	-18.75	-18.75
Alternative 3 (Sensitivity planning approach)	-13	-11	-11

7.11.3.10 Sedimentation of habitats

The impacts related to erosion and sedimentation during the construction phase will be ongoing during the operational, decommissioning and closure phases.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-15	-15
Alternative 3 (Sensitivity planning approach)	-12	-10	-10

7.11.3.11 Bank destabilization and erosion due to blasting

Stockpiles, berms and dam walls may be destabilised by blasting, causing erosion. Stream banks (especially those already exposed or eroded, for example, by alien vegetation or cattle trampling) may also collapse, thus affecting habitats and adding to sediment loads within the channel. Blasting may also cause dust to settle in wetland areas, thus contributing to sedimentation and affecting water quality.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-11	-11
Alternative 3 (Sensitivity planning approach)	-8.25	-8.25	-8.25

7.11.3.12 Invasion by alien vegetation

The impacts related to invasion by alien plants during the construction phase will be ongoing during the operational, decommissioning and closure phases.

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-10	-11.7
Alternative 3 (Sensitivity planning approach)	-13	-10	-11.7

7.11.3.13 Impacts to fish migration and distribution

The introduction of alien species is most often for angling/recreational purposes, but can also be driven by subsistence needs for protein. Alien fish species compete with indigenous fish species for habitat and food, and can have a devastating impact on natural aquatic biota through predation and habitat destruction. Currently, bass is the only alien fish species recorded from the site but its presence on site may explain the absence of other expected species.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-15	-12	-15.96
Alternative 3 (Sensitivity planning approach)	-15	-9	-11.97

7.11.3.14 Loss of sensitive species and decline in biodiversity

All identified impacts (See Appendix A) may potentially contribute to deterioration in the availability or suitability of aquatic habitats, water quality deterioration or flow modifications. Whilst habitats can be rehabilitated with relative ease, impacts to water quality are less reversible and can often lead to the permanent loss of species from a system, even if habitats are available and suitable, diversity and biotic integrity will remain low due to poor water quality.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-25	-21.25	-31.87
Alternative 3 (Sensitivity planning approach)	-25	-21.25	-31.87

7.11.3.15 Cumulative Impacts

Cumulative impacts consider impacts that occur repeatedly or additively over space and time. This includes repetitions of the same impact over time and/or interrelationships with other activities that impact on the same resource (in this case, receiving watercourses).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-25	-22.5	-41.17
Alternative 3 (Sensitivity planning approach)	-25	-22.5	-41.17

7.11.4 DECOMMISSIONING PHASE

7.11.4.1 Water quality and habitats - solid waste and hazardous waste

Removal of infrastructure will generate large quantities of solid waste (including scrap metal, building rubble, etc.) and hazardous waste (oils and grease containers, tyres, fluorescent lights, chemical containers etc.). Hazardous waste can generate leachate which can wash or seep into wetland areas where it can be toxic to aquatic biota and impact on habitats integrity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13.75	-6	-6

Alternative 3 (Sensitivity planning approach)	-13.75	-6	-6

7.11.4.2 Water quality - seepage and AMD

The potential impact for AMD will be ongoing during decommissioning and closure. Potential sources of contamination include pollution control facilities and stormwater trenches, residue at stockpiles, dirty water pipelines, together with ongoing AMD from the open-cast pit and underground workings.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-22.25	-22.25	-41.17
Alternative 3 (Sensitivity planning approach)	-21.25	-21.25	-38.88

7.11.4.3 Increased sedimentation in wetlands as a result of the removal of infrastructure and exposure of soils

Deconstruction of infrastructure will cause exposure of soil surfaces and erosion and the mobilisation of sediment. This will result in increased sediment loads being carried downstream causing increased turbidity, sedimentation and change in instream habitats.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13.75	-12.5	-12.5
Alternative 3 (Sensitivity planning approach)	-12	-10	-10

7.11.4.4 Water quality deterioration related to spills and leaks

The potential for spills and leaks to occur will continue during the decommissioning phase. Water quality may deteriorate as a result of accidental spills during infrastructure removal activities (fuels, cement, etc.) as well as storm water flushing construction areas and dust blown or washed into wetlands. Further spills or leaks may originate from pollution control facilities and dirty water pipelines or drains. Water quality deterioration will affect aquatic fauna intolerant to water quality alteration but can have an impact on all aquatic fauna (especially major fuel, coal or sewage spills).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-21.25	-35.48
Alternative 3 (Sensitivity planning approach)	-21.25	-16	-26.72

7.11.4.5 Invasive Alien Vegetation

The potential impact of invasive alien vegetation is likely to continue post closure. However, the Alien management programme should continue to be implemented well after closure (at least 5 years) to ensure that no alien plants spread to downstream reaches.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-10	-13.3
Alternative 3 (Sensitivity planning approach)	-13	-10	-13.3

7.11.4.6 Water Quality Impacts - Major Spills

The potential for water quality to be affected by spill will continue into the decommissioning phase as there will still be vehicles on site to transport materials on and off site. As such, the potential for contamination of water resources by coal dust, oil etc. is spread across a wide area (three quaternary catchments).

Alternative	Pre-Mitigation	Post-	Final

	Score	Mitigation Score	Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-19	-12.75	-21.29
Alternative 3 (Sensitivity planning approach)	-19	-8.5	-14.19

7.11.4.7 Loss of sensitive species and decline in biotic integrity

Ongoing impacts to the water quality and habitats of the Hlelo tributaries and, to a lesser extent, the Ngwempisi River, will result in gradual ongoing losses of sensitive species and an overall decline in biodiversity and biotic integrity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-19	-18	-23.94
Alternative 3 (Sensitivity planning approach)	-19	-18	-23.94

7.11.5 REHABILITATION AND CLOSURE PHASE

7.11.5.1 Water Quality - Decant and AMD

After closure, the voids will fill with water and eventually decant into adjacent watercourses. AMD will also be ongoing via subsurface seepage. These are likely to have significant impacts on water quality contributing to further ongoing declines in biotic integrity. If this water is metal-rich and acidic, it will potentially cause major declines in abundance, with the potential complete loss of sensitive species, not only within the study area, but also downstream of it.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-25	-21.25	-41.01
Alternative 3 (Sensitivity planning approach)	-25	-21.25	-41.01

7.11.5.2 Decrease in water quantity due to Ingress

After closure the mine voids, both open-cast and underground, will fill with water. This water will effectively be removed from the landscape, causing decreased flows in receiving watercourses. This may have serious consequences within the Hlelo Tributary which already has low to intermittent flows. Habitat availability will be greatly reduced (e.g. pools, lateral connectivity with marginal vegetation) and water quality will deteriorate as water becomes more concentrated. This could have considerable consequences in terms of meeting the requirements of downstream users (including biota). The Ngwempisi River will be less impacted provided that no wetlands are undermined within its catchment.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	21.25	-11.25	-18.78
Alternative 3 (Sensitivity planning approach)	21.25	-11.25	-18.78

7.11.5.3 Sedimentation and erosion during rehabilitation

Earth moving activities during rehabilitation will expose soils and generate dust which may be blown or washed into watercourses.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine	-13.37	-12.5	-12.5

production)			
Alternative 3 (Sensitivity planning approach)	-12	-10	-10

7.11.5.4 Invasion by alien vegetation

The impacts related to invasion by alien plants during the rehabilitation phase will continue post closure and should therefore be monitored regularly.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-10	-11.7
Alternative 3 (Sensitivity planning approach)	-13	-10	-11.7

7.11.5.5 Water quality decline due to solid and hazardous waste

Solid or hazardous waste - e.g. tyres or soils contaminated with coal residue, diesel, oil or grease – can produce toxic substances that leach or get washed into wetlands or groundwater, affecting the biotic integrity and health of the aquatic biota.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11	-6	-6
Alternative 3 (Sensitivity planning approach)	-11	-6	-6

7.11.5.6 Biodiversity losses and decline in biotic integrity

Loss of sensitive aquatic species as a result of ongoing water quality impacts is likely to remain fairly constant until decant commences, after which there is likely to be a steady decline in biotic integrity. Depending on the quality of water decanting, this impact may be transferred along great distances, possibly well into the Hlelo River.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-25	-21.25	-31.87
Alternative 3 (Sensitivity planning approach)	-25	-22.5	33.75

7.11.5.7 Cumulative impacts

Cumulative impacts are likely to increase post closure as AMD intensifies (as a result of the voids filling with water) and water begins to decant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-25	-22.5	-37.57
Alternative 3 (Sensitivity planning approach)	-25	-22.2	-37.57

7.11.6 ALTERNATIVE IMPACT DISCUSSION

Alternative 2 will have a far greater impact on water quality, flows and wetland integrity than Alternative 3 as it will extend across a valley bottom wetland, thus significantly increasing the likelihood of water quality impacts. Alternative 2 will cause the loss of wetland area and will necessitate a stream diversion, which will have additional impacts associated with it, including erosion, flow modifications and water quality.

7.11.7 CONCLUSION

It is the opinion of the specialist that should mining take place, Alternative 3 is the preferred Alternative from an aquatic ecology perspective.

7.12 GROUND WATER IMPACTS

The following is a summary of the geohydrology impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.12.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.12.2 CONSTRUCTION PHASE

7.12.2.1 Clearing topsoil for footprint areas

The clearing topsoil for footprint areas can increase infiltration rates to the various groundwater systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-17.5	-35
Alternative 3 (Sensitivity planning approach)	-7.5	-7.5	-7.5

7.12.2.2 Ground water quality

Handling of waste and construction can cause various types of spills (hydrocarbons) on site that may infiltrate the groundwater system.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-17.5	-35

Alternative 3 (Sensitivity planning approach)	-4.5	-3.75	-3.75

7.12.3 OPERATION PHASE

7.12.3.1 Dewatering

Mining may potentially result in groundwater inflows into the workings and the resultant dewatering may occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-17.5	-35
Alternative 3 (Sensitivity planning approach)	-15	-15	-17.5

7.12.3.2 Reduction in stream baseflow

Mining may potentially result in groundwater inflows into the workings and the resultant reduction in stream baseflow.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-20	-20	-40
Alternative 3 (Sensitivity planning approach)	-9.75	-9.75	-11.37

7.12.3.3 Coal Stockpiles

The stockpiling of coal may expose coal to water and oxygen, potentially resulting in ARD stockpiles. Contamination of the groundwater system may occur as a result.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-7.5	-15
Alternative 3 (Sensitivity planning approach)	-7.5	-7.5	-8.75

7.12.3.4 Ground water quality

The life of mine for the mine is planned at 10 years. This allows sufficient time for chemical reactions to take place in the mined out areas, stockpiles and other potential pollution sources to produce AMD conditions.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-17.5	-17.5	-35
Alternative 3 (Sensitivity planning approach)	-4.5	-3.75	-3.75

7.12.4 DECOMMISSIONING PHASE

No impacts have been identified for this phase.

7.12.5 REHABILITATION AND CLOSURE PHASE

7.12.5.1 Groundwater contaminant plume

Once the mining has ceased, ARD is still likely to form in the facility. Therefore a groundwater contaminant plume is likely to migrate from the mining area once the water level in the workings have reached long term steady state conditions. The contaminant plume emanating from the underground will move in a south easterly direction. The plume is likely to extend ~500m to the south east after 50 years post closure. After 100 years post closure the plume is likely to have migrated 700-1000m south east. The contaminant concentration is likely to increase over time as the plume develops.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-21.25	-42.5
Alternative 3 (Sensitivity planning approach)	-13	-12	-16

7.12.5.2 Contaminated groundwater seepage to streams (salt load)

Over time the water within the aquifer may potentially begin to move within the aquifer and into other streams potentially spreading contaminated water to other systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-21.25	-42.5
Alternative 3 (Sensitivity planning approach)	-15	-15	-20

7.12.5.3 Decant from underground

Decanting occurs when the mine water level in the underground workings rebounds to a level above the topographic elevation, resulting in mine water discharging onto surface. Surface decanting refers to direct discharge of mine water to surface through backfilled boxcut material. Decant take place at the lowest topographic level that intersects the flow path and/or mine workings. Presently it is not anticipated that the old workings on site will influence the decant as there are barriers between the workings. However, should these be distrubed the potential exists for the old workings to influence the decant of the proposed Leiden project.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-23.75	-23.75	-47.5
Alternative 3 (Sensitivity planning approach)	-21.25	-18.75	-37.5

7.12.6 ALTERNATIVE IMPACT DISCUSSION

7.12.6.1 Alternative 1

This Alternative will imply that no development takes place and that the environment remains unchanged and unaltered. The proposed development site for the Leiden Coal Mine comprises a mixture of “undisturbed” natural vegetation and forestry. As no mining will take place no groundwater impacts are likely to occur. It must however be mentioned that the groundwater (borehole LDNBH4) and surface water (WN1) has been impact by contaminants do to the process of ARD.

7.12.6.2 Alternative 2

In this Alternative, the mining and production of coal is emphasised and mining is considered to have replaced the dominant forestry land use. Less restrictive mitigation measures will be used to protect the environmental features, thus allowing for maximum coal production and promotion of economic aspects. This approach will increase the financial viability of the proposed Leiden Coal Mine at the potential cost of impacting more severely on environmental features. For more information on this Alternative please refer to the EIMS Scoping report.

This Alternative is likely to have the largest impact on the groundwater environment. In the construction phase the footprint clearing and handling of waste and construction can cause various types of spills (hydrocarbons) which can infiltrate and contaminate the groundwater and surface water system.

For the operational phase, the extent of drawdown will cause a significantly reduction in base flow of the unnamed tributary which will be mined out. A large impact on groundwater quality is likely to occur, as all pit water will collect in the pit at the position of the mined out stream.

Post closure the largest impacts are likely. The base flow reduction due to the mining will be permanent. A groundwater contaminant plume will develop along the sediments in the stream down gradient which may impact on surface water users downstream. Decant of the mining area will occur at the lowest topographical point of the opencast (1451 mamsl). Decant will occur and the will on the surface water users downstream.

7.12.6.3 Alternative 3

Alternative 3 emphasises the resource protection and stringent mitigation measures to minimize identified adverse impacts. The impacts on groundwater levels and as contaminant transport away from the contaminant sources due to the proposed Alternative 3 mining activities were quantified using the 3-D numerical groundwater flow and contaminant transport model.

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the underground mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Pumping water that seeps into the mine areas to surface will cause dewatering of the surrounding aquifers and an associated decrease in groundwater level within the zone of influence of the dewatering cone.

The zone of influence of the dewatering cone depends on several factors including the depth of mining below the regional groundwater level, recharge from rainfall to the aquifers, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedule (at the time of investigation) also taken in consideration when calculating the drawdown.

No privately owned boreholes are likely to be impact by lowering of groundwater levels. A number of monitoring boreholes may however be slightly impacted. The base flow to the unknown stream located to the south of the surface infrastructure and underground portal may reduce by the dewatering activities (refer to Figure 57).

It was possible to calculate the inflow into the underground for each year. The computed inflow into the underground workings is shown in Table 29, based on the mine schedules. Due to several assumptions that had to be made for this model, these numbers must be considered as order of magnitude only, and actual values could deviate considerably from these.

Table 29: Inflow into underground workings

Year	Inflow Volumes	Confidence Level	
	Mine Inflow	[Less 30 %]	[Higher 30 %]
	[m^3/year]	[m^3/year]	[m^3/year]
1	166	116	215
2	274	192	357

3	415	290	539
4	497	348	646
5	548	384	713
6	625	437	812
7	658	460	855
8	696	487	905
9	742	520	965
10	716	501	931

The mine inflows into the underground workings is likely to increase from ~170 m^3/d in year 1 to ~720 m^3/d in year 10.

It must be cautioned that these calculations have been done using simplified assumptions of homogeneous aquifer conditions. The reality could deviate substantially from this and the model should thus be updated as more information becomes available.

The life of mine for the mine is planned at 10 years. This allows sufficient time for chemical reactions to take place in the mined out areas, stockpiles and other potential pollution sources to produce AMD conditions. Groundwater flow directions will however, be directed towards the mining area due to the mine dewatering. Therefore, contamination will be contained within the mining area, and little contamination will be able to migrate away from the mining area.

Once the mining has ceased, ARD is still likely to form in the facility. Therefore a groundwater contaminant plume is likely to migrate from the mining area once the water level in the workings have reached long term steady state conditions (i.e. each underground mine water level has reached the decant level). The migration of contaminated water from the workings has been simulated for 50 and 100 years after colliery closure. Experience has shown that the plume stagnates after about 80-100 years, and no further movement after such time is expected. The simulated contaminant plumes are shown in Figure 58 and Figure 59.

The contaminant plume emanating from the underground will move in a south easterly direction. The plume is likely to extend ~500m to the south east after 50 years post closure. After 100 years post closure the plume is likely to have migrated 700-1000m south east. The contaminant concentration is likely to increase over time as the plume develops.

No privately owned boreholes located in the fractured Karoo aquifer is likely to be impacted based on the impact simulations. However shallow contaminated seepage may impact on the unnamed tributaries located south east of the proposed underground workings. The SO_4 salt load contribution from contaminated groundwater seepage in the stream can be seen in Table 30. The underground is likely to be the main contaminant sources which may impact on the salt load of the unnamed stream located south of the surface infrastructure. It must be noted that this does not include any contribution from decant.

Table 30: Salt load contributions

Contaminant source	Average baseflow volumes (m^3/s)*	SO_4 salt load (kg/d)	max SO_4 concentration in seepage (mg/l)	SO_4 concentration increase in River (mg/l)
Underground workings	0.03	14	800	5

Decanting occurs when the mine water level in the underground workings rebounds to a level above the topographic elevation, resulting in mine water discharging onto surface. Surface decanting refers to direct discharge of mine water to surface through backfilled boxcut material. Decant take place at the lowest topographic level that intersects the flow path and/or mine workings. The location of the decant positions can be seen in Figure 60. A summary of the decant level and volume can be seen in Table 31.

Table 31: Decant volume level and volume

Mine Block	Decant level (mamsl)	Expected decant volume (m3/day)			Description
		2% recharge	4% recharge	6% recharge	
Underground	1463	100	200	310	Decant through box cut

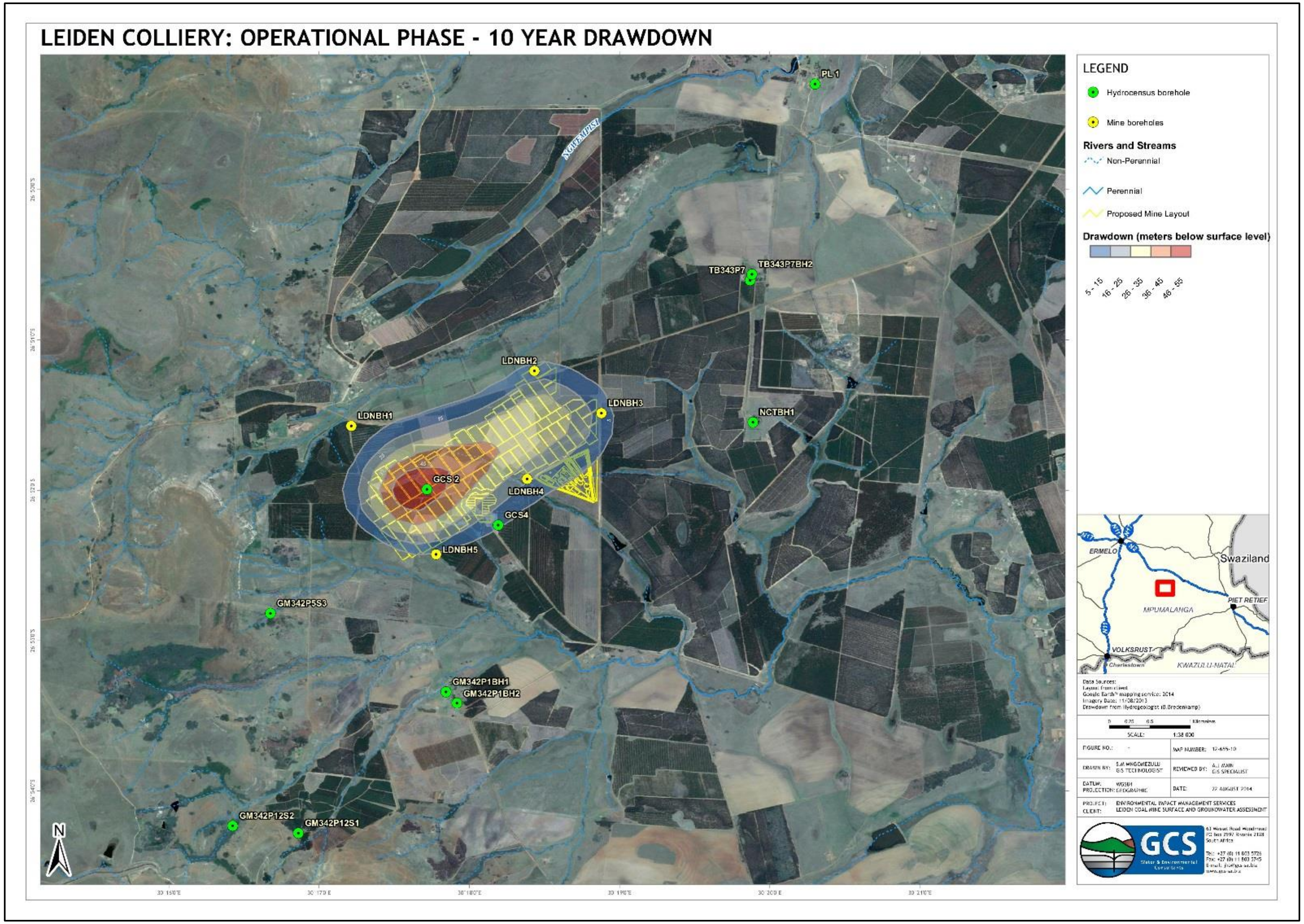


Figure 57: Groundwater drawdown – year 10

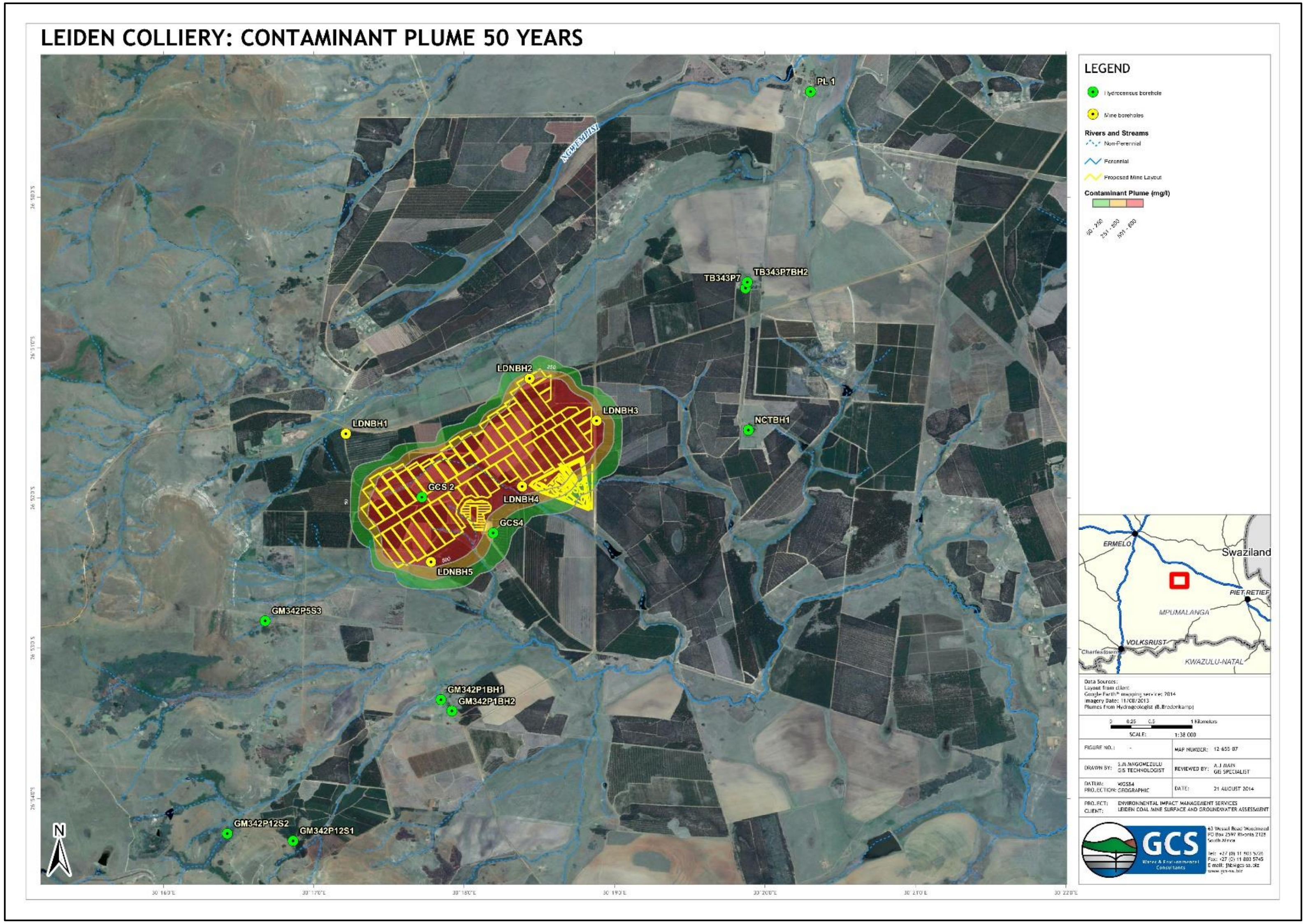


Figure 58: Simulated SO4 Contaminant Plume (50 years post closure)

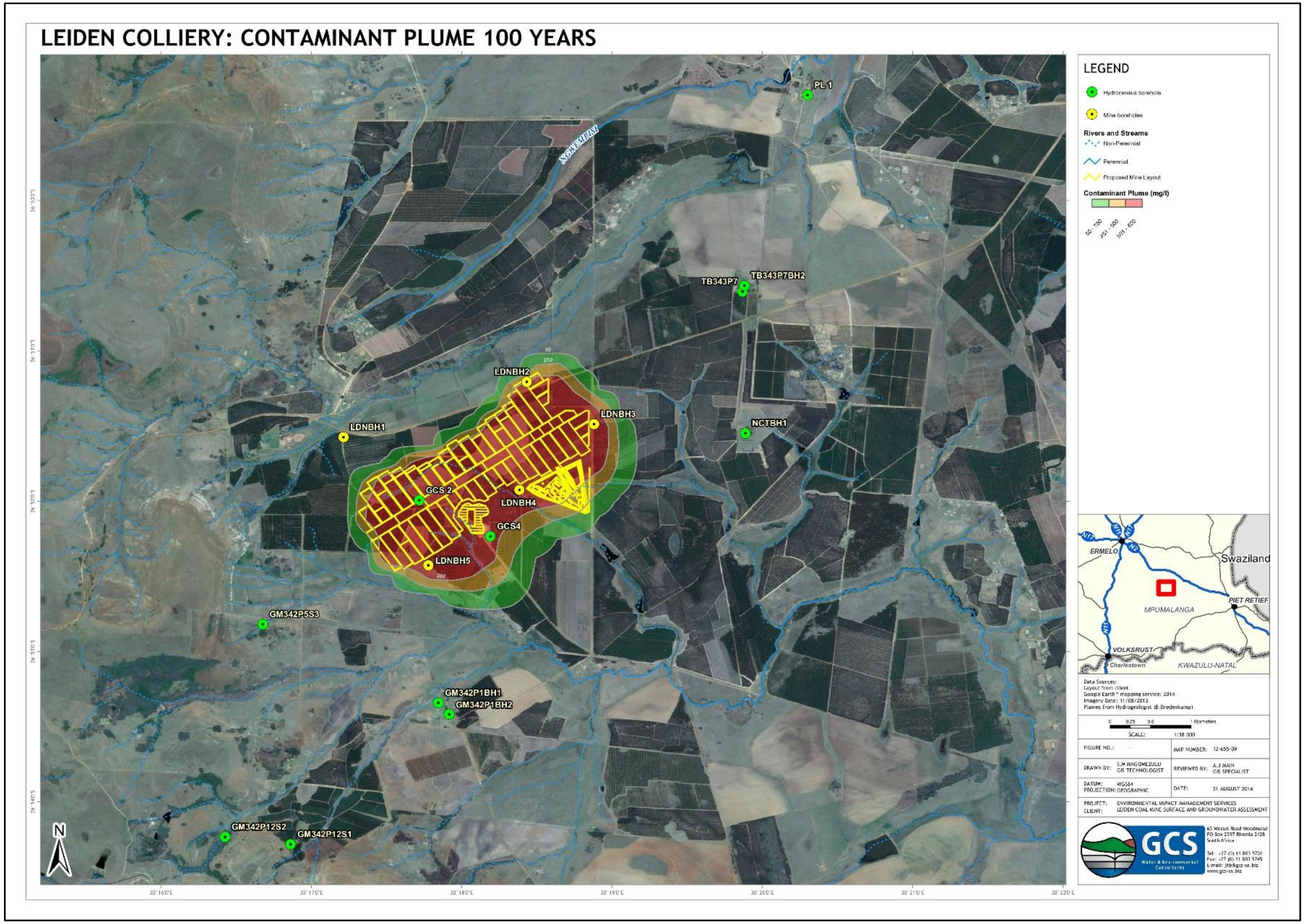


Figure 59: Simulated SO4 Contaminant Plume (100 years post closure)

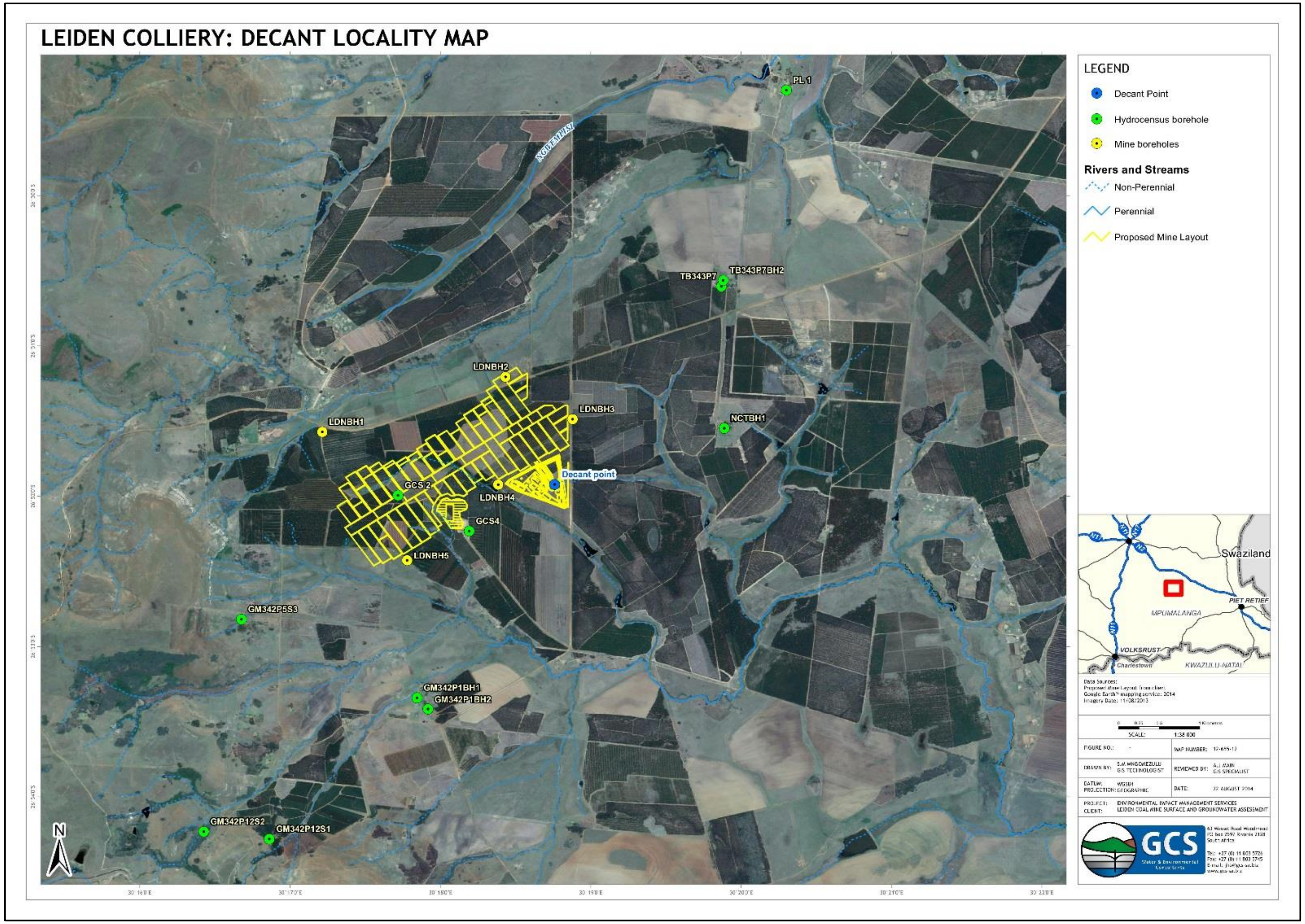


Figure 60: Location of potential decant position

7.12.7 CONCLUSION

Based on the above it is the opinion of the specialist that Alternative 3 is the preferred development Alternative from a ground water perspective.

7.13 AIR QUALITY IMPACTS

The following is a summary of the air quality impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.13.1 PLANNING AND DESIGN PHASE

7.13.1.1 Nuisance Dust

Dust will occur due to onsite during the planning phase activities by both people and vehicles and their related equipment that may cause entrained dust as people move from place to place. Nuisance dust fall occurs when dust-fall rates exceeding the residential guideline of 600 mg/m²/day, beyond the mine boundary. Farming activities, and nearby mining add to the cumulative nature of this impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-6.75	-6.75	-11.25
Alternative 3 (Sensitivity planning approach)	-6	-6	-9

7.13.2 CONSTRUCTION PHASE

7.13.2.1 Nuisance Dust

The construction phase and related activities will generate large volumes of dust from the surface. Such sources of dust are; (transport, loading, blasting and entrainment by the passage of vehicles). Dust impacts on flora and fauna affecting respiration and transpiration as well as causing nuisance dust in surrounding areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	-9	-8	-9.3
Alternative 3 (Sensitivity planning approach)	-12	-5	-7.5

7.13.3 OPERATION PHASE

7.13.3.1 Nuisance Dust

During the operation phase the mining operations and activities have the potential to produce both total suspended particles and particulate matter. The continuous production of the dust into the atmosphere can become harmful to flora (clogging stomata) and contributing to human and mammal respiratory illnesses.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-12	-24
Alternative 3 (Sensitivity planning approach)	-16	-7.5	-11.25

7.13.4 DECOMMISSIONING PHASE

7.13.4.1 Nuisance Dust

The decommissioning phase will see the cessation of mining activities, thereafter dust-fall rates are likely to reduce. However, the impact will still be present as the rehabilitation activities will still cause fall out dust to occur on the site. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-10	-16.6
Alternative 3 (Sensitivity planning approach)	-13	-5.5	-8.25

7.13.5 REHABILITATION AND CLOSURE PHASE

7.13.5.1 Nuisance dust fall

The rehabilitation and closure phase is less likely to impact on the surrounding area and its inhabitants as a result of the limited activities that are generally dust creating. The dust impact may still occur as a result of areas that have not yet been fully vegetated.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-10	-15
Alternative 3 (Sensitivity planning approach)	-12	-5.5	7.3

7.13.6 ALTERNATIVE IMPACT DISCUSSION

For impact assessment purposes, the maximum mine Alternative was not included in the dispersion modelling as this Alternative was given to unfeasible due to its potential negative impacts on a wetland area within the project study area. It is qualitatively assessed in the Impact Assessment based on similar opencast operations in the region. The sensitivity planning approach was included in the dispersion modelling as this is the Alternative that is the most feasible to be granted the go-ahead. The No-Go Alternative will not result in any air pollution impacts.

The modelled simulations for Alternative 3 with no mitigation measures in place are as follows;

NO_2 and SO_2 were simulated and shown not to exceed their relative assessment criteria. NO_2 was simulated to reach exceed the hourly limit of 200 µg/m³ for 68 hours at a single point in the modelling domain. This point falls within the mine boundary area.

Figure 61 shows the simulated highest daily $PM_{2.5}$ concentration of 40 µg/m³ for an area of approximately 700 m north and 500 m south of the 18 km access road as well as 500 m east of the proposed operations main entrance. Simulations indicate exceedances of the current and 2016 daily $PM_{2.5}$ NAAQ limit off-site (Figure 62) for the same areas, only this time simulations show 4 days of exceedance of 40µg/m³ reaching an area approximately 500 m north and 250 m south of the 18 km access road as well as 300 m east of the proposed operations main entrance. Simulated annual average $PM_{2.5}$ concentrations (Figure 63) also exceed current and 2016 NAAQS off-site, but never more than 100 m away from the main entrance and 18 km access road.

Simulated highest daily PM_{10} concentrations are shown in Figure 64, where both the current (120 µg/m³) and 2015 (75 µg/m³) NAAQ limit values are reached outside of the mine boundary. The area of exceedance extends approximately 1000 m east of the proposed operation's boundary. The future NAAQS limit value of 75 µg/m³ is also exceeded approximately 1500 m east of this boundary. The area over which simulated daily PM_{10} concentrations exceed the NAAQS limit value of 75 µg/m³ more than the permitted 4 days per year is depicted in Figure 65. The area of exceedance is again to the east of the proposed site boundary, which correlates with the simulated highest daily concentrations as seen in Figure 64. The area of exceedance extends approximately 800 m east of this boundary as well as approximately 200 m north and south of the proposed access road to and from Ermelo to the proposed operation. Simulated annual average PM_{10} concentrations (Figure 66) exceed the current and future NAAQS of 50 µg/m³ and 40 µg/m³ respectively mostly onsite. The area of exceedance extends approximately 100 m east of the main entrance to the proposed operations, outside of the proposed operations boundary.

Simulated dustfall rates are depicted in Figure 67. The NDCR for residential and industrial areas (600 and 1200 mg/m²/day) is reached off-site. It is however not reached at any sensitive receptor or residential area included in this study. The residential limit is reached approximately 500 m east of the main entrance to the proposed operations, as well as approximately 400 -500 m north and south of the proposed access/haul road to and from Ermelo. This is in the vicinity of the sensitive receptor number 17, named Local school 2.

Simulated dustfall rates for every sensitive receptor in the vicinity of the proposed operations are provided in the Air Quality Report in Appendix N

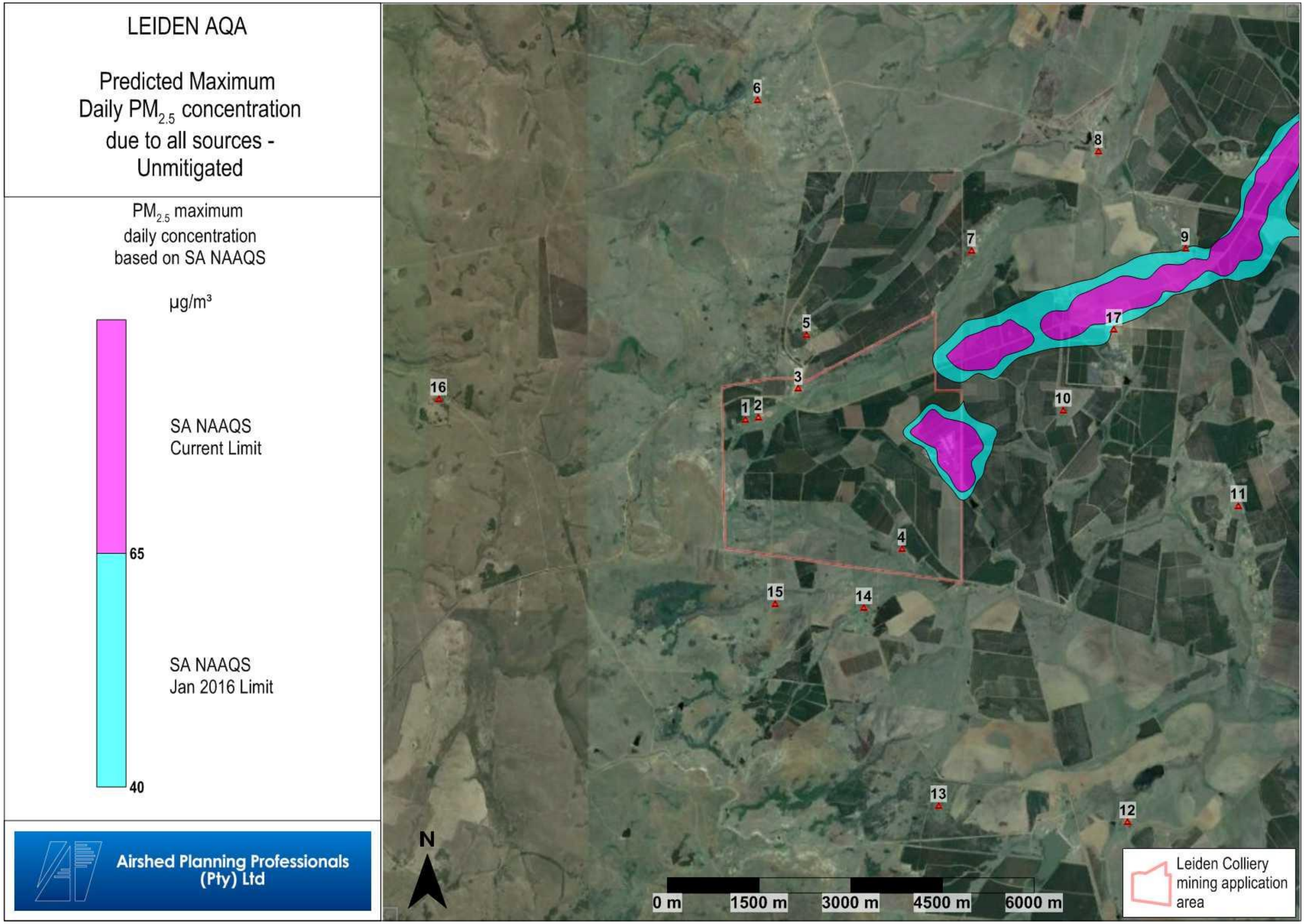


Figure 61: Simulated PM2.5 highest daily concentration (Jan. 2010 - Dec. 2012) - unmitigated

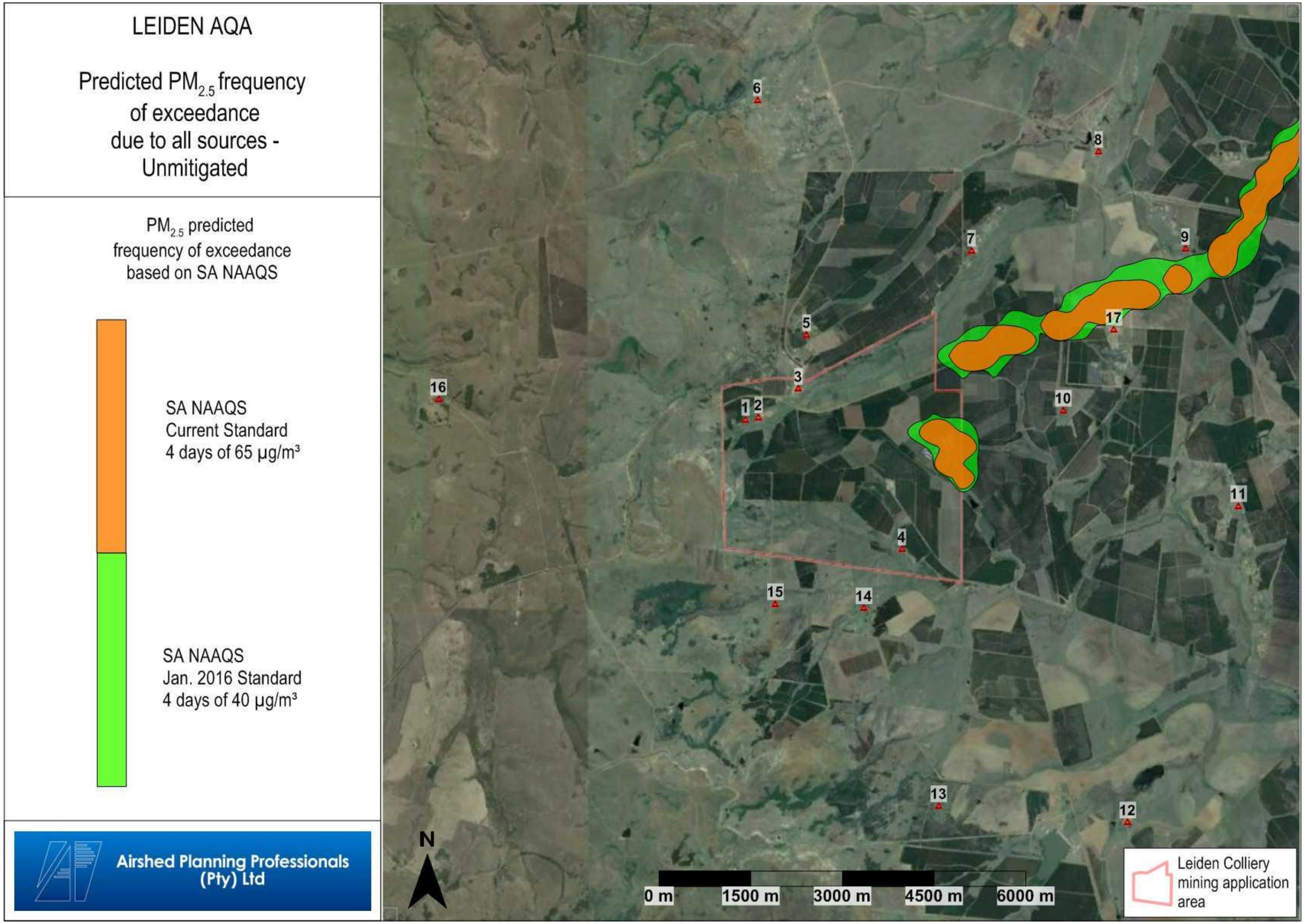


Figure 62: Simulated PM2.5 frequency of exceedance (Jan. 2010 - Dec. 2012) - unmitigated

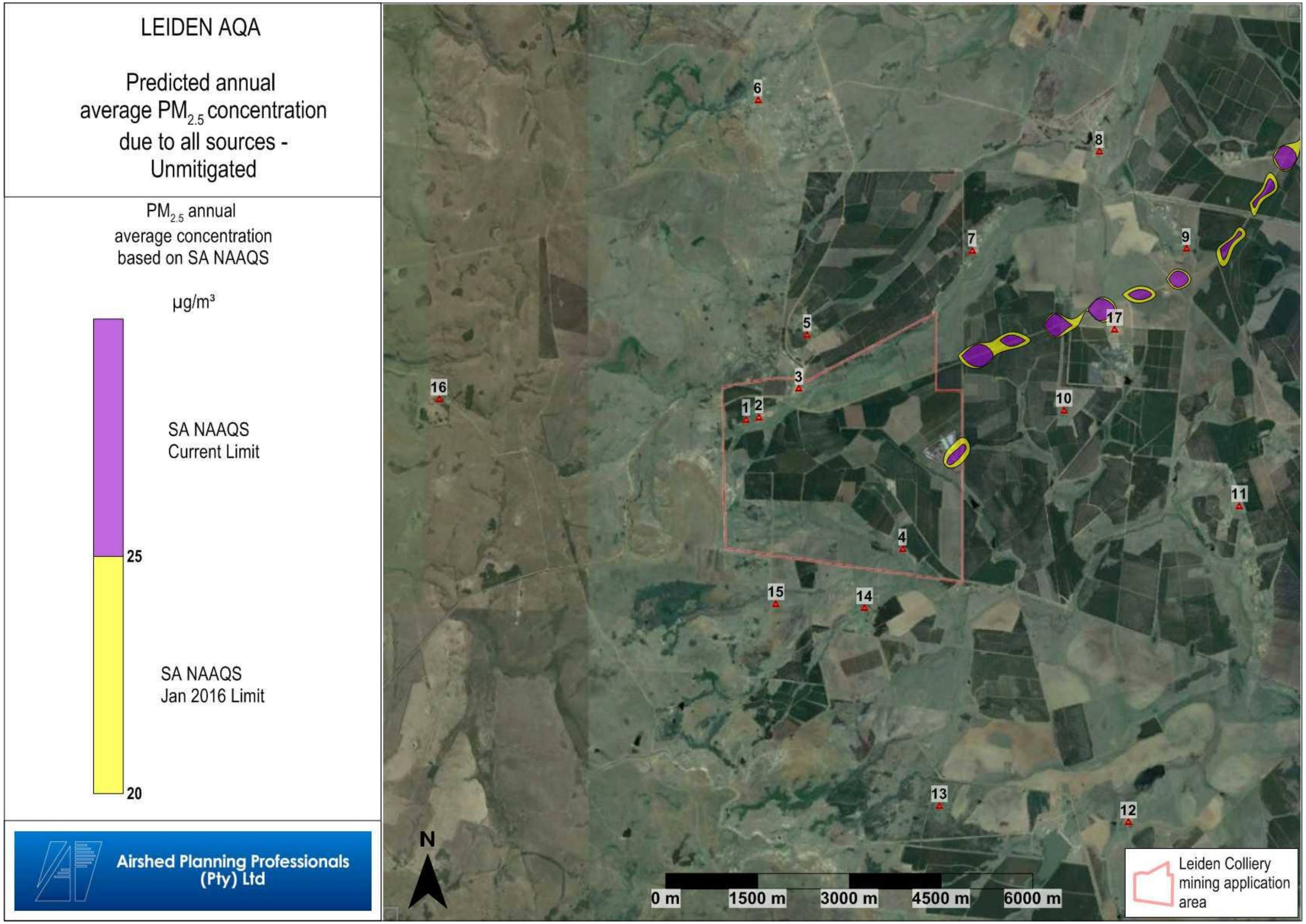


Figure 63: Simulated PM2.5 annual average concentration (Jan. 2010 - Dec. 2012) - unmitigated

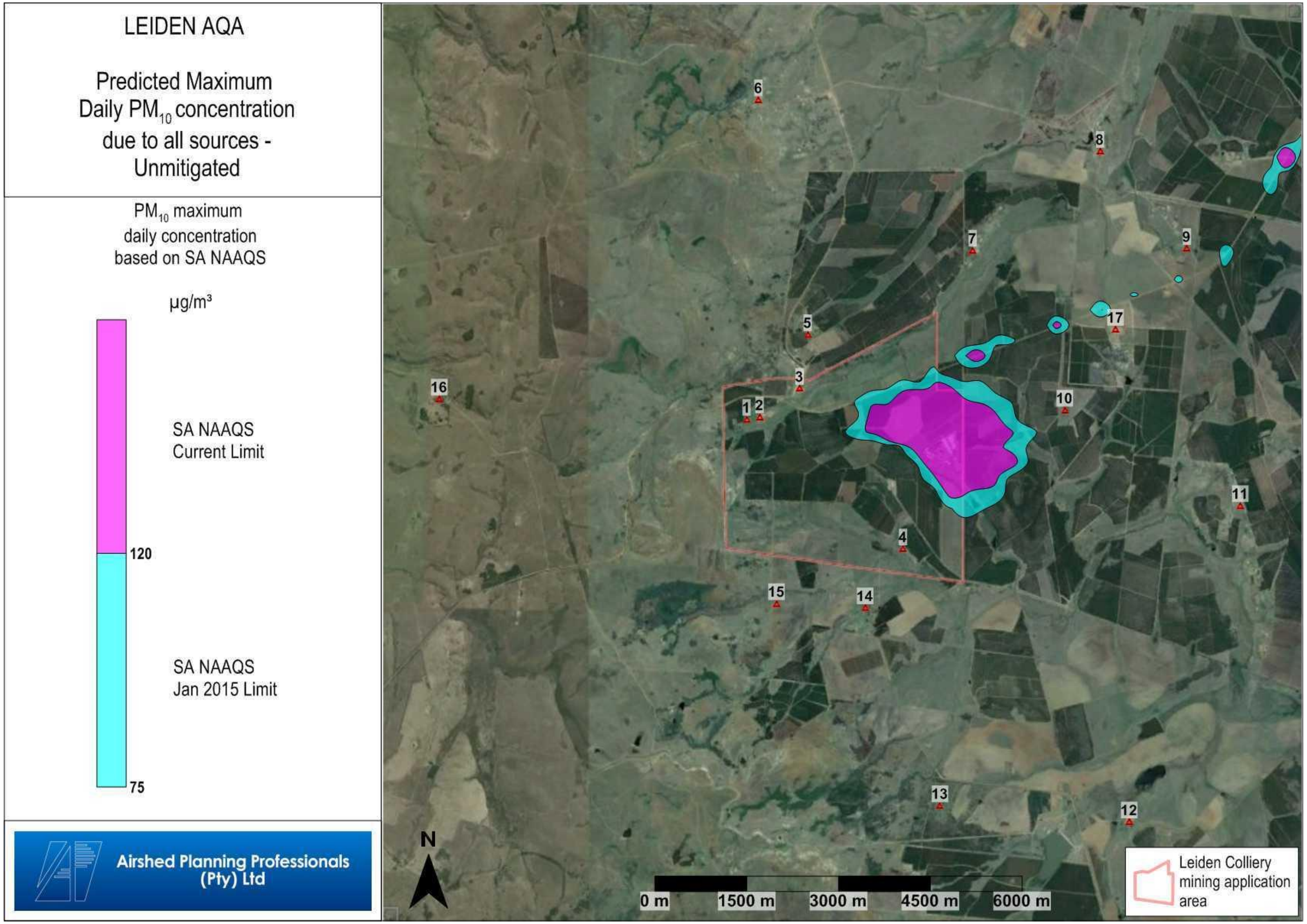


Figure 64: Simulated PM10 highest daily concentration (Jan. 2010 - Dec. 2012) - unmitigated

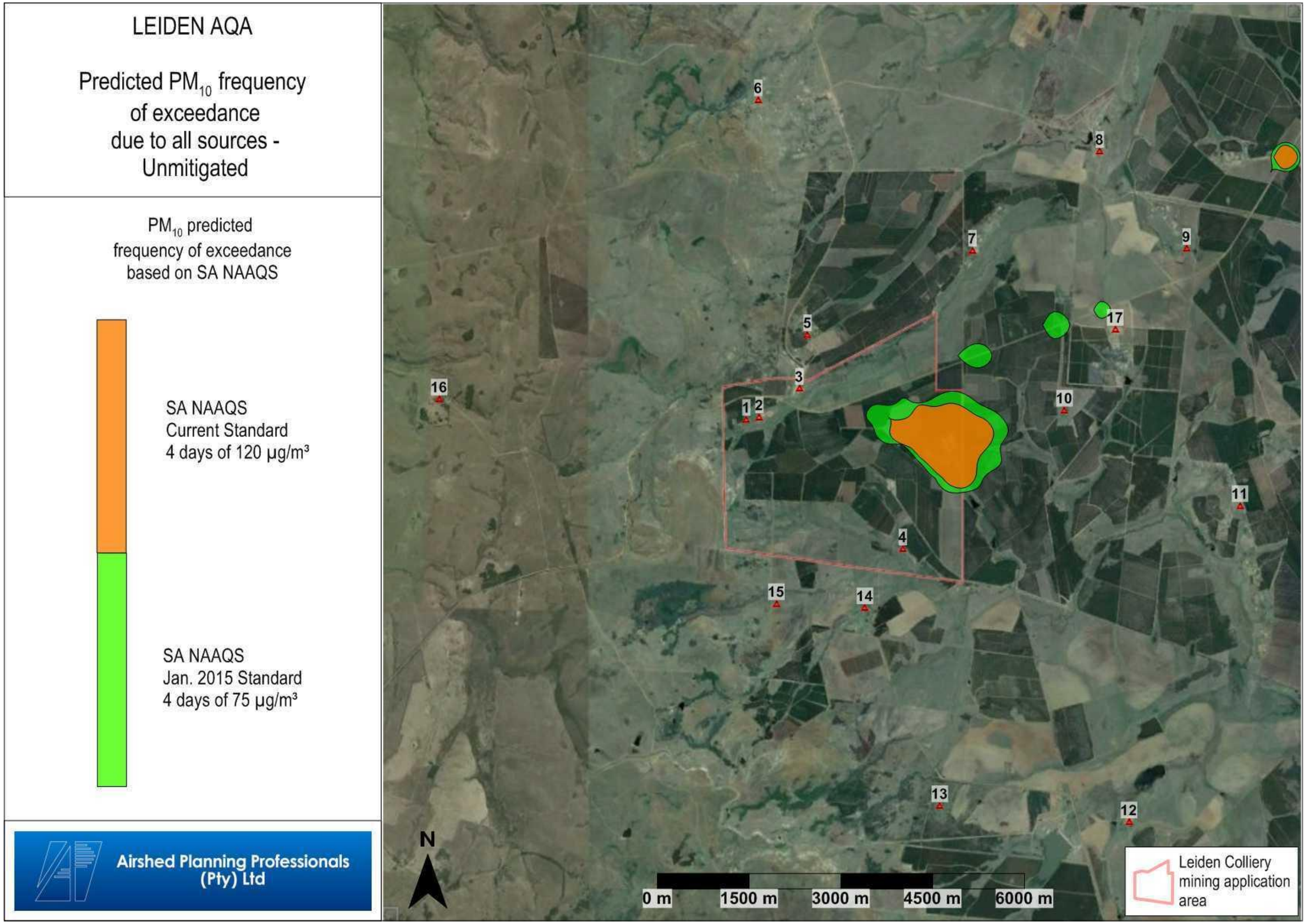


Figure 65: Simulated PM10 Frequency of Exceedance (Jan. 2010 - Dec. 2012) - unmitigated

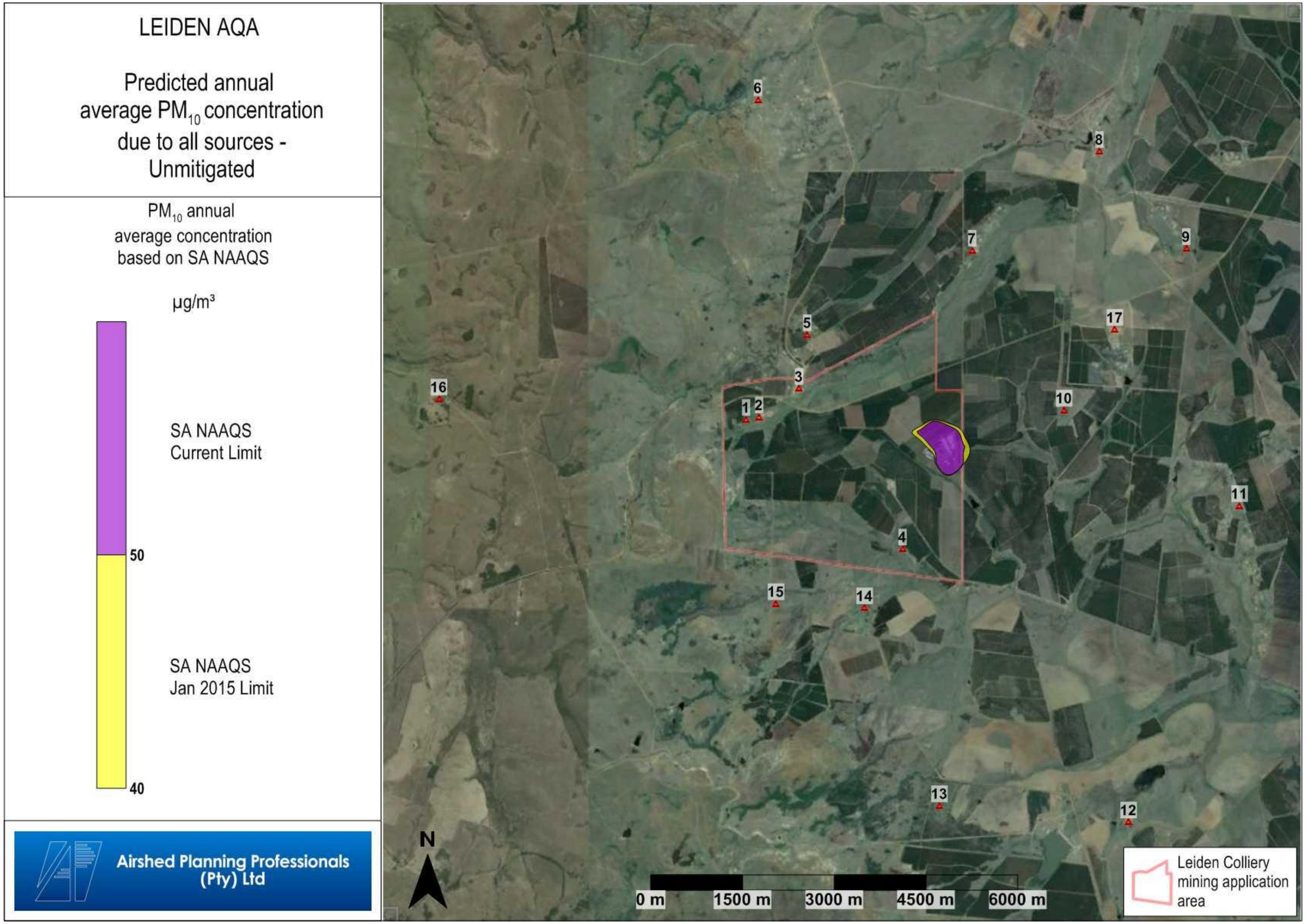


Figure 66: Simulated PM10 annual average concentration (Jan. 2010 - Dec. 2012) - unmitigated

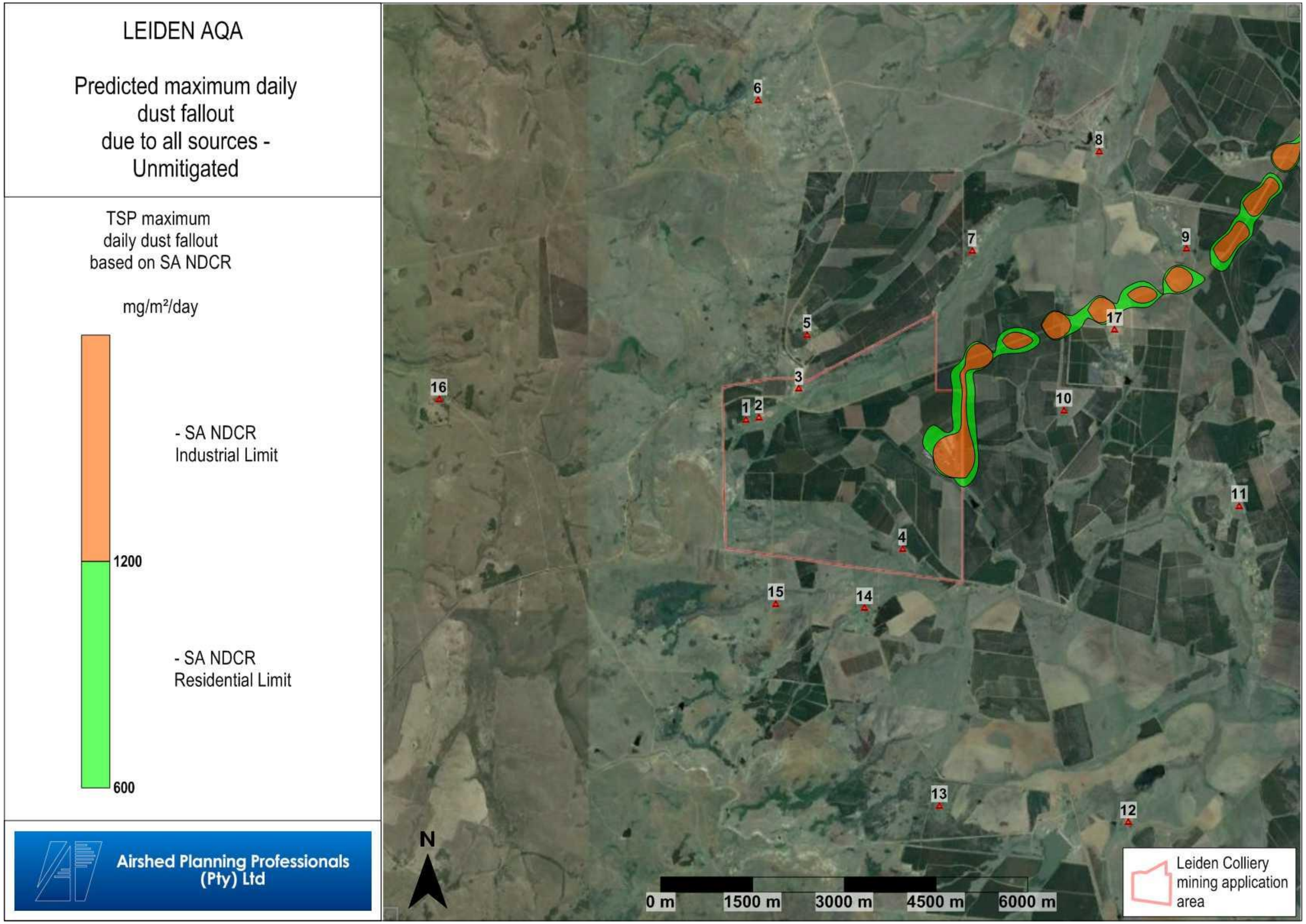


Figure 67: Simulated maximum daily dustfall (TSP) concentrations (Jan. 2010 - Dec. 2012) - unmitigated

Modelled simulations for the sensitive plan approach alternative where mitigation measures are placed on wind erodible, crushing and unpaved road activities are as follows:

NO_2 and SO_2 were simulated not to exceed their relative assessment criteria and not additional mitigation measures were applied.

Figure 68 shows the simulated highest daily $PM_{2.5}$ concentrations, where an area approximately 400 m north and 200 m south of the 18 km access road as well as 350 m east of the proposed operations main entrance reaches a concentration of 40 µg/m³. Simulations indicated exceedances of the current and 2016 daily $PM_{2.5}$ NAAQ limit off-site (Figure 69) for relatively the same areas, only this time simulations show 4 days of exceedance of 40 µg/m³ reaching an area approximately 350 m north and 150 m south of the 18 km access road as well as 150 m east of the proposed operations main entrance. Simulated annual average $PM_{2.5}$ concentrations (Figure 70) do not exceed current and future NAAQS off-site.

Simulated highest daily PM_{10} concentrations are shown in Figure 71, where both the current (120 µg/m³) and 2015 (75 µg/m³) NAAQ limit values are reached outside of the mine boundary. The area of exceedance extends approximately 800 m east of the proposed operation's boundary. The 2015 NAAQS limit value of 75 µg/m³ is also exceeded approximately 1300 m east of this boundary. The area over which simulated daily PM_{10} concentrations exceed the NAAQS limit value of 75 µg/m³ more than the permitted 4 days per year is depicted in Figure 72. The area of exceedance is again to the east of the proposed site boundary, which correlates with the simulated highest daily concentrations as seen in Figure 71. The area of exceedance extends approximately 700 m east of this boundary. Simulated annual average PM_{10} concentrations (Figure 73) exceed the current and 2015 NAAQS of 50 µg/m³ and 40 µg/m³, respectively, on-site only.

Simulated dustfall rates are depicted in Figure 74. The NDCR for residential and industrial areas (600 and 1200 mg/m²/day) is reached off-site, this is localized to within 100 m of the proposed access road to and from Ermelo. It is not reached at any sensitive receptor or residential area included in this study. The residential limit is reached approximately 50 m east of the main entrance to the proposed operations, as well as approximately 100 m north and south of the proposed access/haul road to and from Ermelo in certain areas.

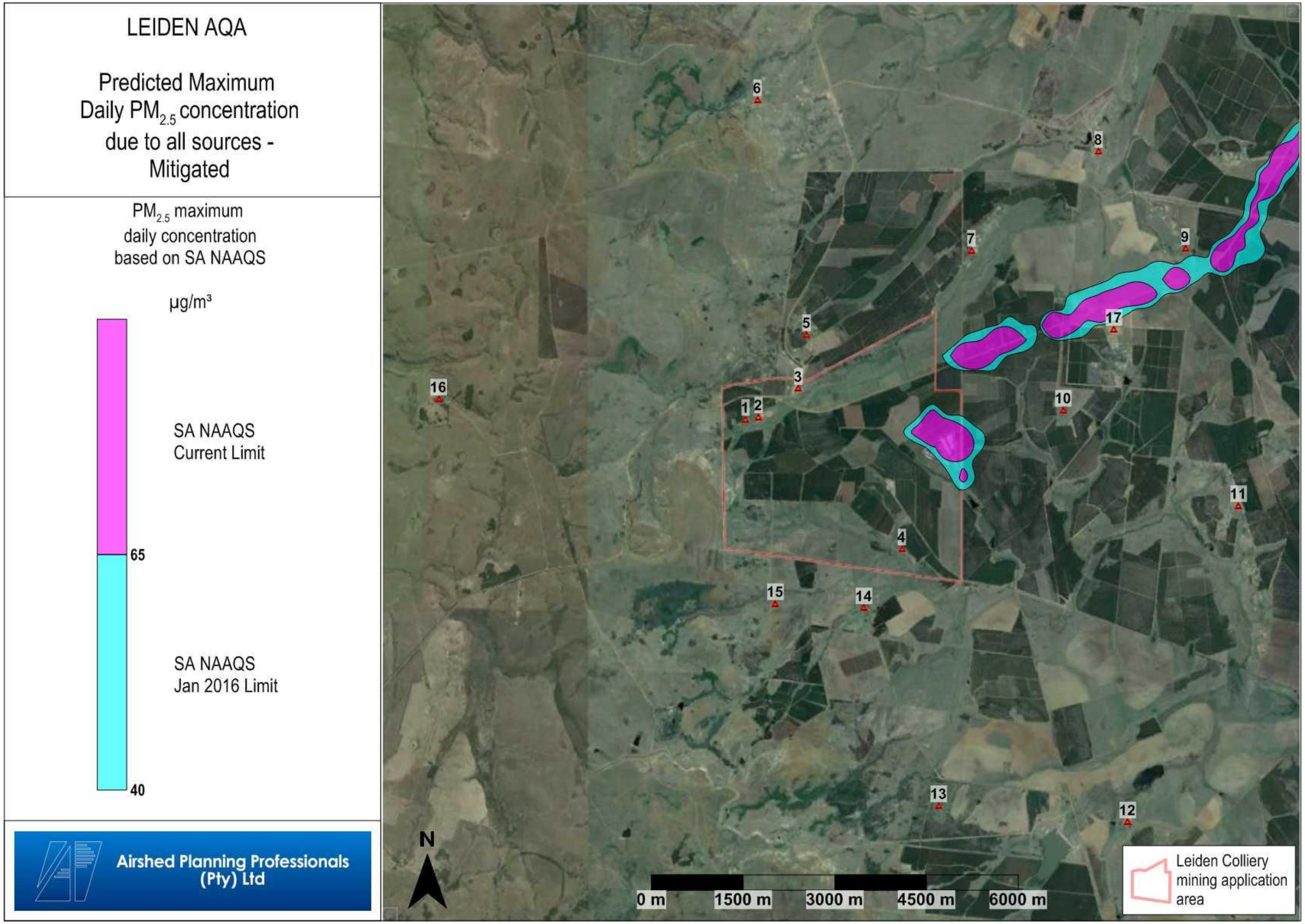


Figure 68: Simulated PM2.5 highest daily concentration (Jan. 2010 - Dec. 2012) - mitigated

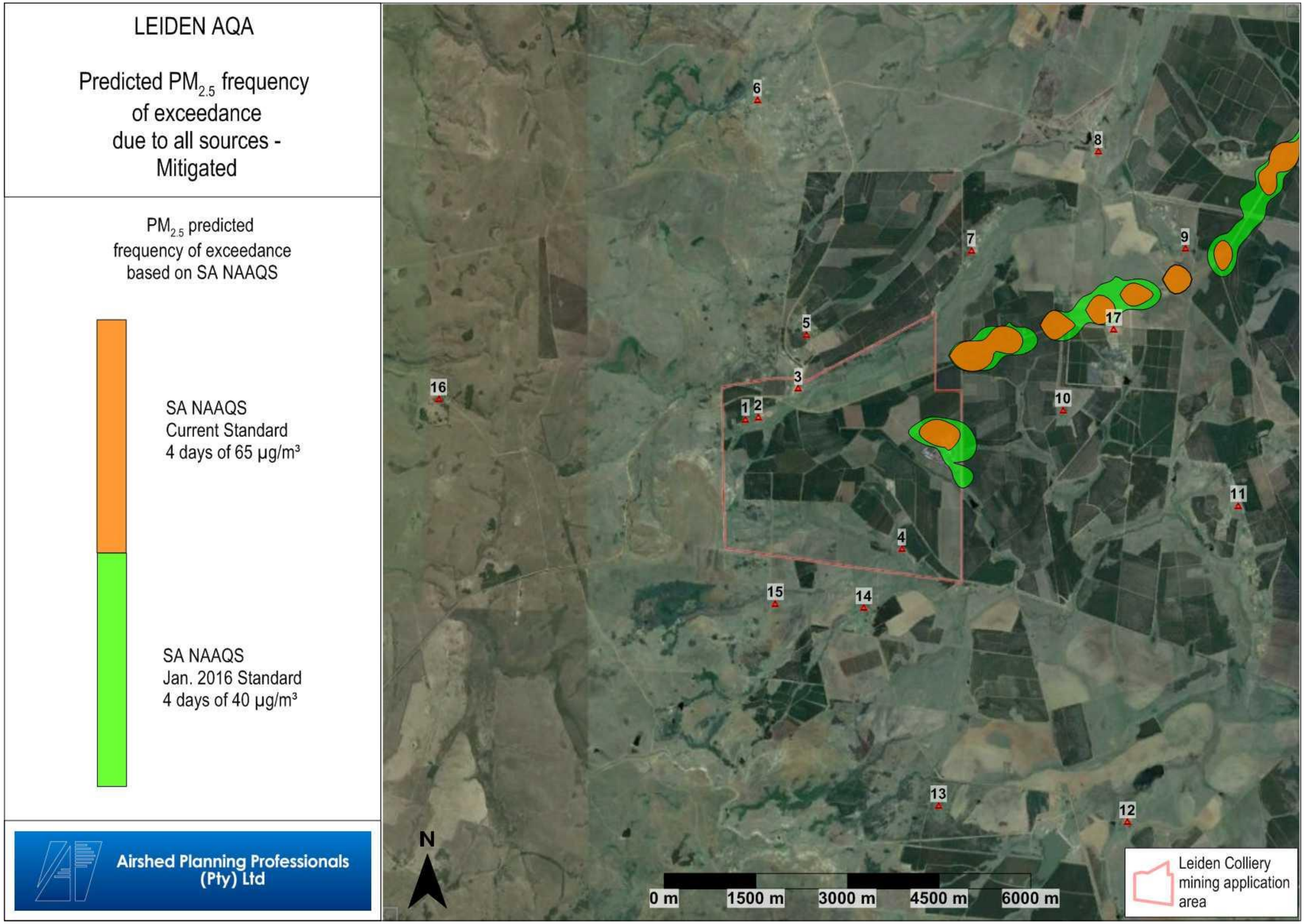


Figure 69: Simulated PM2.5 frequency of exceedance (Jan. 2010 - Dec. 2012) - mitigated

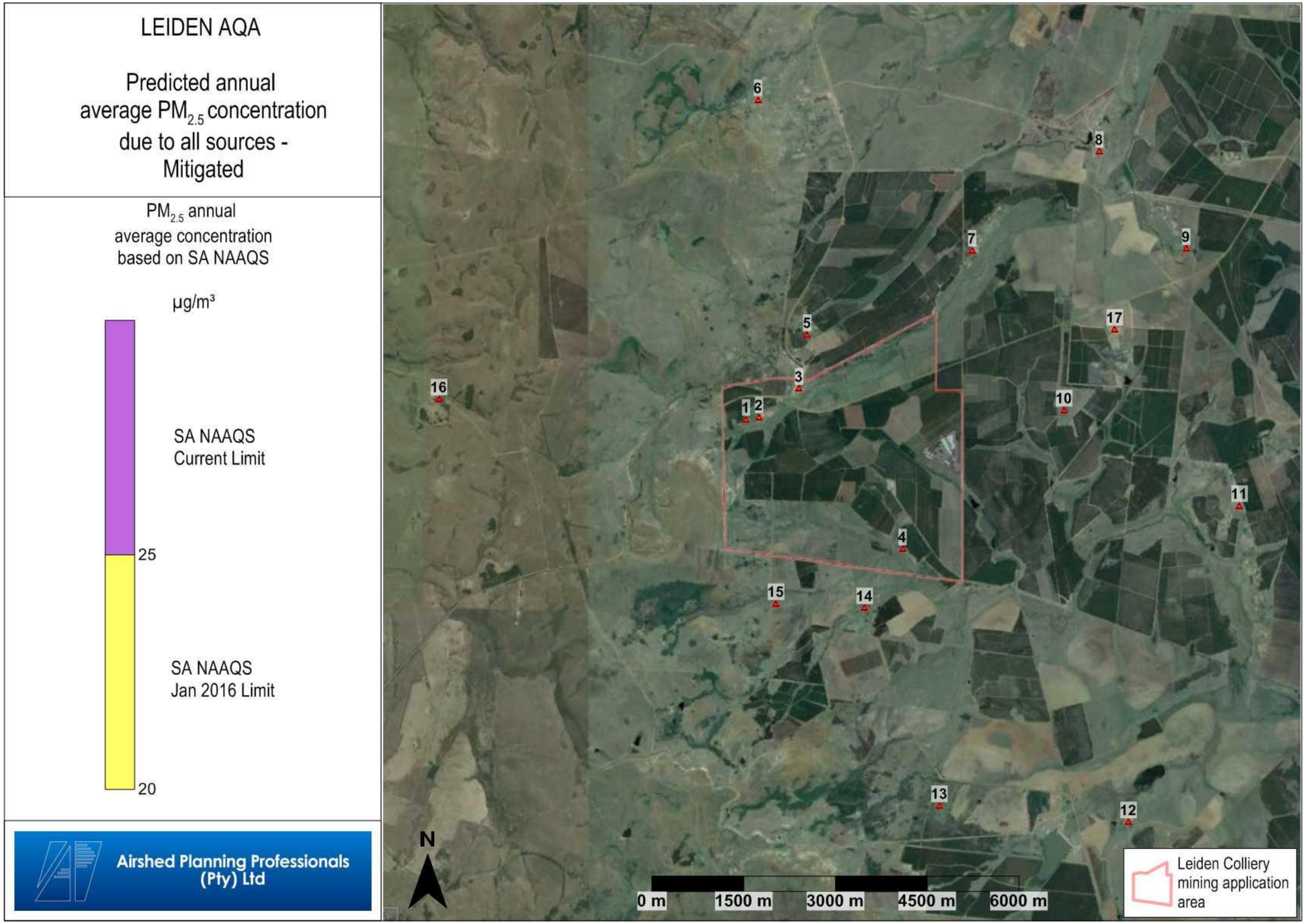


Figure 70: Simulated PM2.5 annual average concentration (Jan. 2010 - Dec. 2012) - mitigated

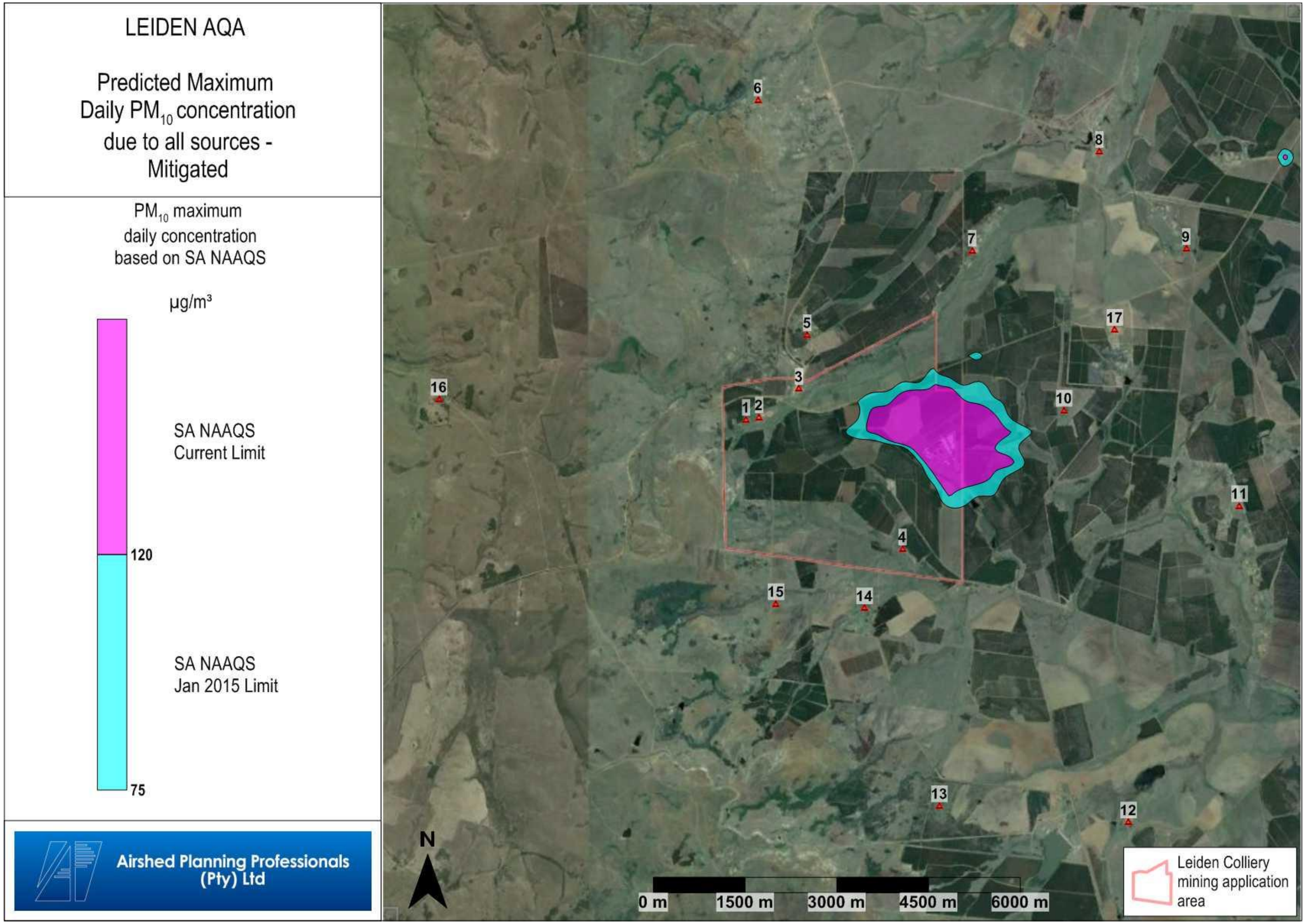


Figure 71: Simulated PM10 highest daily concentration (Jan. 2010 - Dec. 2012) - mitigated

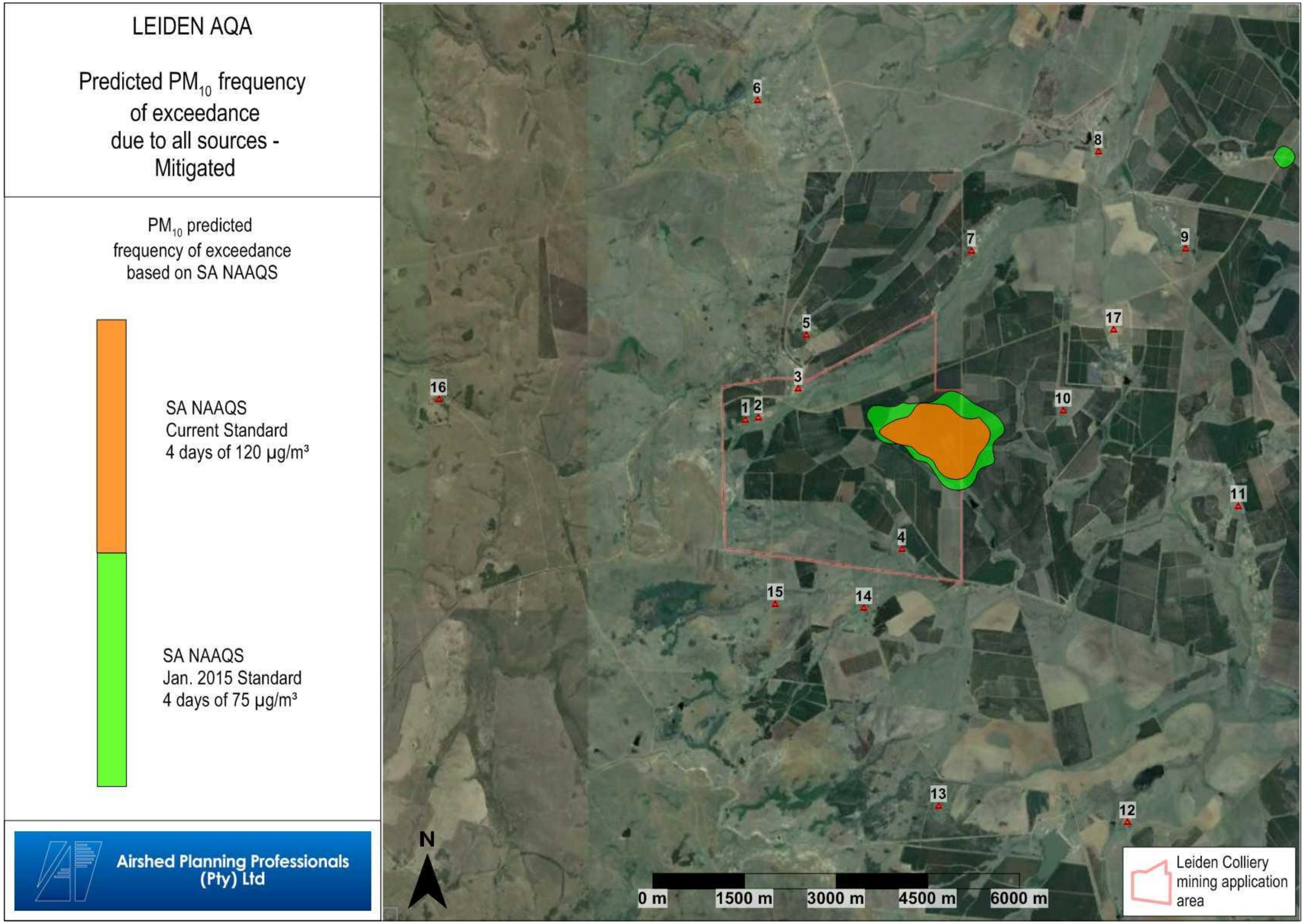


Figure 72: Simulated PM10 Frequency of Exceedance (Jan. 2010 - Dec. 2012) - mitigated

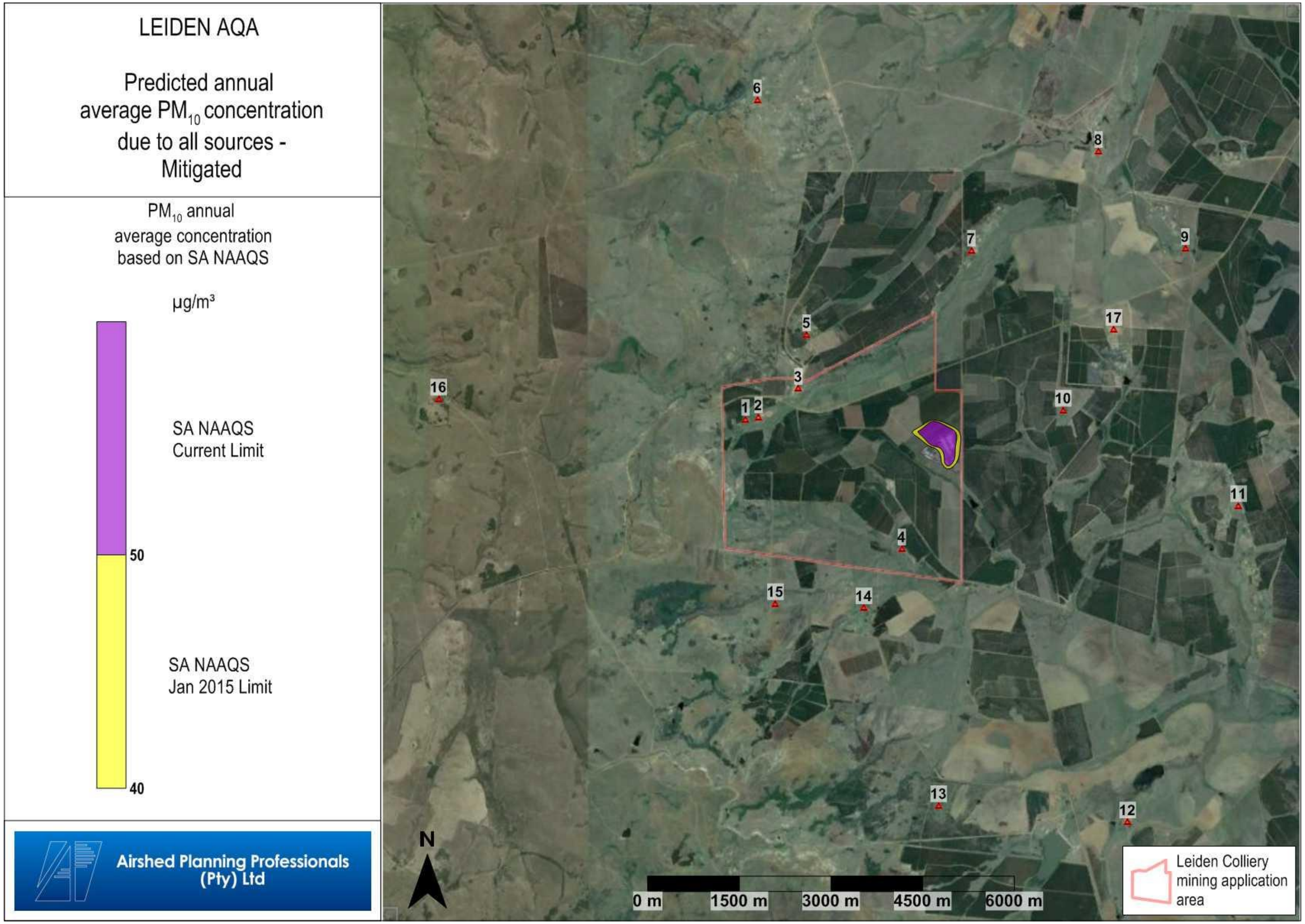


Figure 73: Simulated PM10 annual average concentration (Jan. 2010 - Dec. 2012) - mitigated

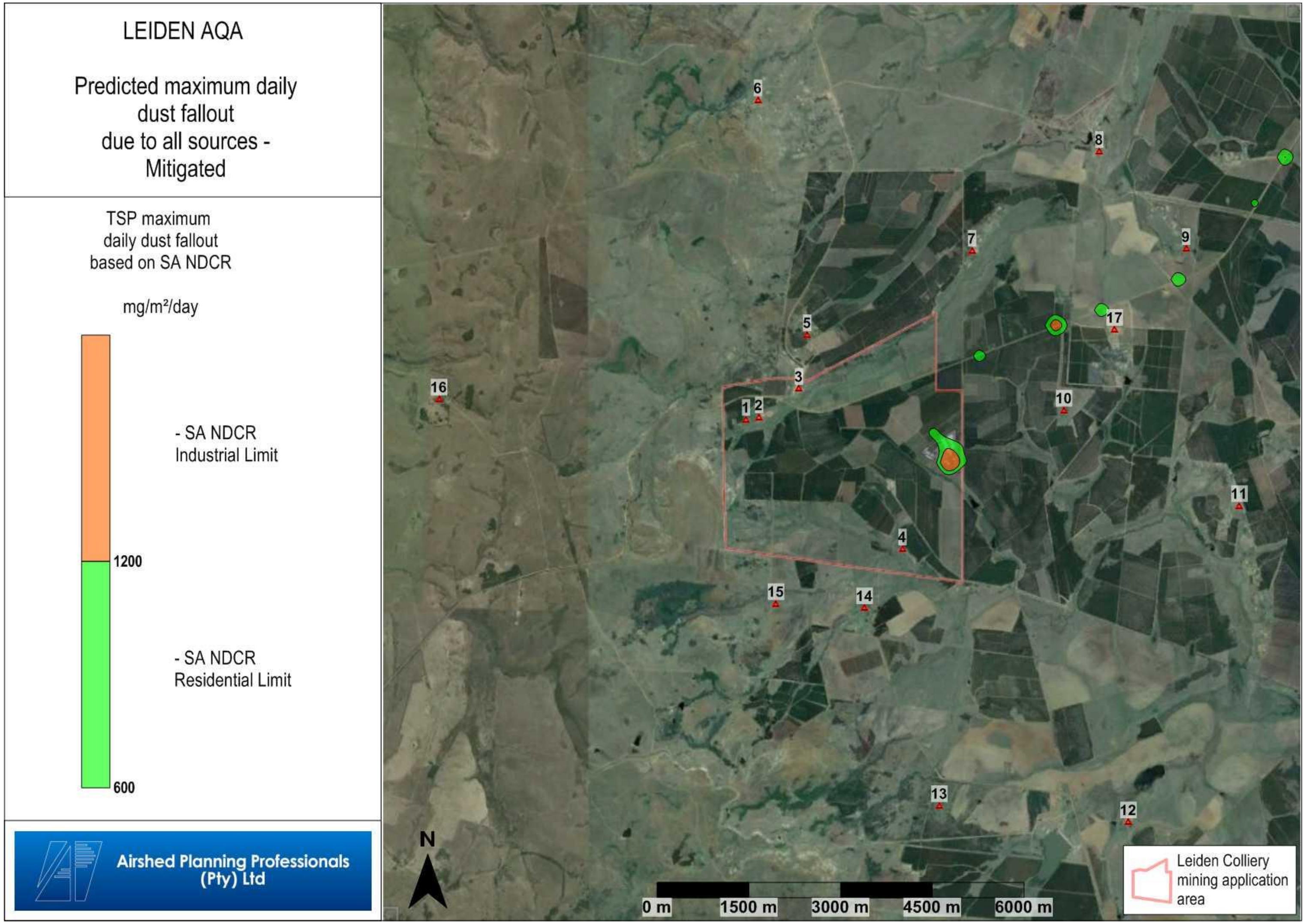


Figure 74: Simulated maximum daily dustfall (TSP) concentrations (Jan. 2010 - Dec. 2012) - mitigated

7.13.7 CONCLUSION

In the opinion of the specialist, Alternative 3 with the application of the recommended mitigation measures is the preferred Alternative from an air quality perspective.

7.14 VISUAL IMPACTS

The following is a summary of the visual impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.14.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.14.2 CONSTRUCTION PHASE

7.14.2.1 Sense of place

During the construction phase the proposed mining area will begin to be cleared in preparation for the mines associated infrastructure. This clearance and the infrastructure will transform the landscape.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-13	-15.16
Alternative 3 (Sensitivity planning approach)	-13	-13	-15.16

7.14.2.2 Visibility

The impact of visibility refers to the potential zone of influence. (How far the operations may potentially be seen by passers-by or residence).

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine	-13	-13	-15.16

production)			
Alternative 3 (Sensitivity planning approach)	-13	-13	-15.16

7.14.2.3 Visual exposure

Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-13	-15.16
Alternative 3 (Sensitivity planning approach)	-13	-13	-15.16

7.14.3 OPERATION PHASE

7.14.3.1 Sense of place

During the operation phase the potential for the impact of sense of place will increase as the as the mines operations extend off site in the form of coal being transported to the Delta plant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-14	-16.33
Alternative 3 (Sensitivity planning approach)	-14	-14	-16.33

7.14.3.2 Visibility

Due to the expansion of the operations off site, the mining operations will become more visible to viewers. Viewers that would not normally be impacted on by the infrastructure may potentially be exposed to haul trucks passing their land daily.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-14	-16.33
Alternative 3 (Sensitivity planning approach)	-14	-14	-16.33

7.14.3.3 Visual exposure

As will visibility, the visual exposure will increase with the expansion of the operations during the operational phase.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-14	-14	-16.33
Alternative 3 (Sensitivity planning approach)	-14	-14	-16.33

7.14.4 DECOMMISSIONING PHASE

7.14.4.1 Sense of place

The decommissioning phase will see a decrease in the impact on sense of place as he mine operations begging to decrease. During decommissioning, the mines infrastructure will be removed, this will decrease the visual impact to the surrounding areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-13	-15.16
Alternative 3 (Sensitivity planning approach)	-13	-13	-15.16

7.14.4.2 Visibility

The visibility of the mining operations will decrease during the decommissioning phase due to the removal of infrastructure.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-13	-15.16
Alternative 3 (Sensitivity planning approach)	-13	-13	-15.16

7.14.4.3 Visual exposure

The visibility of the mining operations will decrease during the decommissioning phase due to the decrease in trucks transporting coal off site..

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-13	-13	-15.16
Alternative 3 (Sensitivity planning approach)	-13	-13	-15.16

7.14.5 REHABILITATION AND CLOSURE PHASE

7.14.5.1 Sense of place

During the rehabilitation phase, a rehabilitation programme will be followed in an attempt to rehabilitate the disturbed mining area back to prior mining conditions or better where possible.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine	-10	-9	-10.5

production)			
Alternative 3 (Sensitivity planning approach)	-10	-9	-10.5

7.14.5.2 Visibility

The visibility impact during the rehabilitation phase will be minimal in terms of onsite activities, during rehabilitation however the mining scars will be visible until rehabilitated.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-9	-10.5
Alternative 3 (Sensitivity planning approach)	-10	-9	-10.5

7.14.5.3 Visual exposure

Visual exposure to the mining site will be minimal, however during the rehabilitation phase evidence (mining scars) will still be visible until fully rehabilitated.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-9	-10.5
Alternative 3 (Sensitivity planning approach)	-10	-9	-10.5

7.14.6 ALTERNATIVE IMPACT DISCUSSION

In the light of the discussions of the report, the *environmental significance* for sense of place, visibility as well as visual exposure will be *low* for **Alternative 1**. For **Alternative 2**, the *environmental significance* for the impact on sense of place, visibility and visual exposure will be *medium* for all phases. This would be the same for **Alternative 3** where the *environmental significance* of all aspects will also be *medium* for all phases. It should be noted that the effects of the proposed mitigation measures, will reduce the intensity / magnitude of the measured aspects in the rehabilitation and closure phase. This does however not result in a difference in the *final environmental significance* rating.

7.14.7 CONCLUSION

From a visual perspective both of the development Alternatives are equally significant and therefore there is no preferred Alternative.

7.15 NOISE IMPACTS

The following is a summary of the noise and blasting impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.15.1 PLANNING AND DESIGN PHASE

7.15.1.1 Impacts on Communities

The current status quo of the noise environment is one of rural and forestry. The dominant source of noise is natural, being mainly wind induced noises, animals, insects and birds. Vehicle movement and agricultural activities (such as the cutting and moving of trees and livestock related sounds) will impact and increase these sound levels especially during the day.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1.25	-1.25	-1.25
Alternative 3 (Sensitivity planning approach)	-1.25	-1.25	-1.25

7.15.2 CONSTRUCTION PHASE

7.15.2.1 Impacts on Communities

The noise generated during the construction phase will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations, in different sequences and on different parts of the construction site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1.25	-1.25	-2.25
Alternative 3 (Sensitivity planning approach)	-1.25	-1.25	-2.25

7.15.3 OPERATION PHASE

7.15.3.1 Impacts on Communities

During the operation phase the following sources of noise are likely to occur; surface preparation activities (vegetation stripping and topsoil removal), General noises generated at a number of undefined activities (workshop, adit, etc. – worst case scenario), the mines ventilation fan for underground operations, plant activities (crushing, screening, stockpiling and material movement), and the hauling of product offsite.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2	-2	-3
Alternative 3 (Sensitivity planning approach)	-2	-2	-3

7.15.4 DECOMMISSIONING PHASE

7.15.4.1 Impacts on Communities

During the decommissioning phase the noise emitted from the mining site may consist of the following; Demolishing of infrastructure, closing (sealing) of the adit, loading, hauling, placing and shaping of waste and discard dumps, shaping of any voids, walls and berms or alternatively the backfilling of the final void.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine	-1.5	-1.5	-2.25

production)			
Alternative 3 (Sensitivity planning approach)	-1.5	-1.5	-2.25

7.15.5 REHABILITATION AND CLOSURE PHASE

7.15.5.1 Impacts on Communities

Minimal noise impacts will occur during the rehabilitation phase. However typical activities to occur during this phase that may influence the noise experienced within the area are; Loading, hauling, placing and shaping of topsoil (all disturbed areas, including stockpile sites and demolished infrastructure); seeding of rehabilitated areas; ripping and seeding of unnecessary roads; and continued maintenance activities continued monitoring (surface and groundwater); maintenance and care of rehabilitated areas; and potential rehabilitation with ground subsidence.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1.5	-1.5	-2.25
Alternative 3 (Sensitivity planning approach)	-1.5	-1.5	-2.25

7.15.6 ALTERNATIVE IMPACT DISCUSSION

7.15.6.1 Alternative 1: No-go option

The ambient sound levels will remain as is, typical of a rural area where agricultural activities may raise it temporary.

7.15.6.2 Alternative 2: Opencast Coal mining activity

The opencast coal mining activity would introduce additional sounds to the predominantly agricultural community. The mining activity will most likely be audible at night during quiet periods, but the change in sound levels will be low, estimated to be less than 3 dB (closest receptors will know the activity is there). The significance of this noise impact is low. Sound levels will be slightly higher (1 – 2 dB) at the receptors located north-west of the activity than the other receptors, although these noise levels will be insignificant.

7.15.6.3 Alternative 3: Underground coal mining activity

The underground coal mining activity would introduce additional sounds to the predominantly agricultural community. The mining activity will most likely be audible at night during quiet periods, but the change in sound levels will be low, estimated to be less than 3 dB (closest receptors will know the activity is there). The noise levels will be slightly higher at the receptors staying east of the activity, but the magnitude of these levels will be insignificant and the significance of this noise impact is low. In terms of acoustics there is no preference between the two Alternatives.

The worst case scenario is assumed for the following Alternative discussion. Night-time (22:00 – 06:00) operations will be assessed in this section as night-time hours are when a quiet environment is desired. Sound generally propagates better at night and receptors are more sensitive about potential intrusive or disturbing noises. The following assumptions were included:

- There are no topsoil berms that will attenuate the noise propagation;
- Receptors are regarded at 1.5 m height in relation to the surrounding environment and Noise sources considered at 2.0 m from ground level elevation;
- Intervening ground conditions of a medium soft nature (acoustically absorbent – some of the sound waves hitting the ground surface is absorbed);
- Activities functioning during wind-still conditions, in good sound propagation conditions (20^{o}C and 80% humidity – typical of a cool summer night); and
- The start of a box-cut at the expanded opencast area on surface level.

Projected Noise Levels in the area due to the construction phase are illustrated in Figure 75 below.

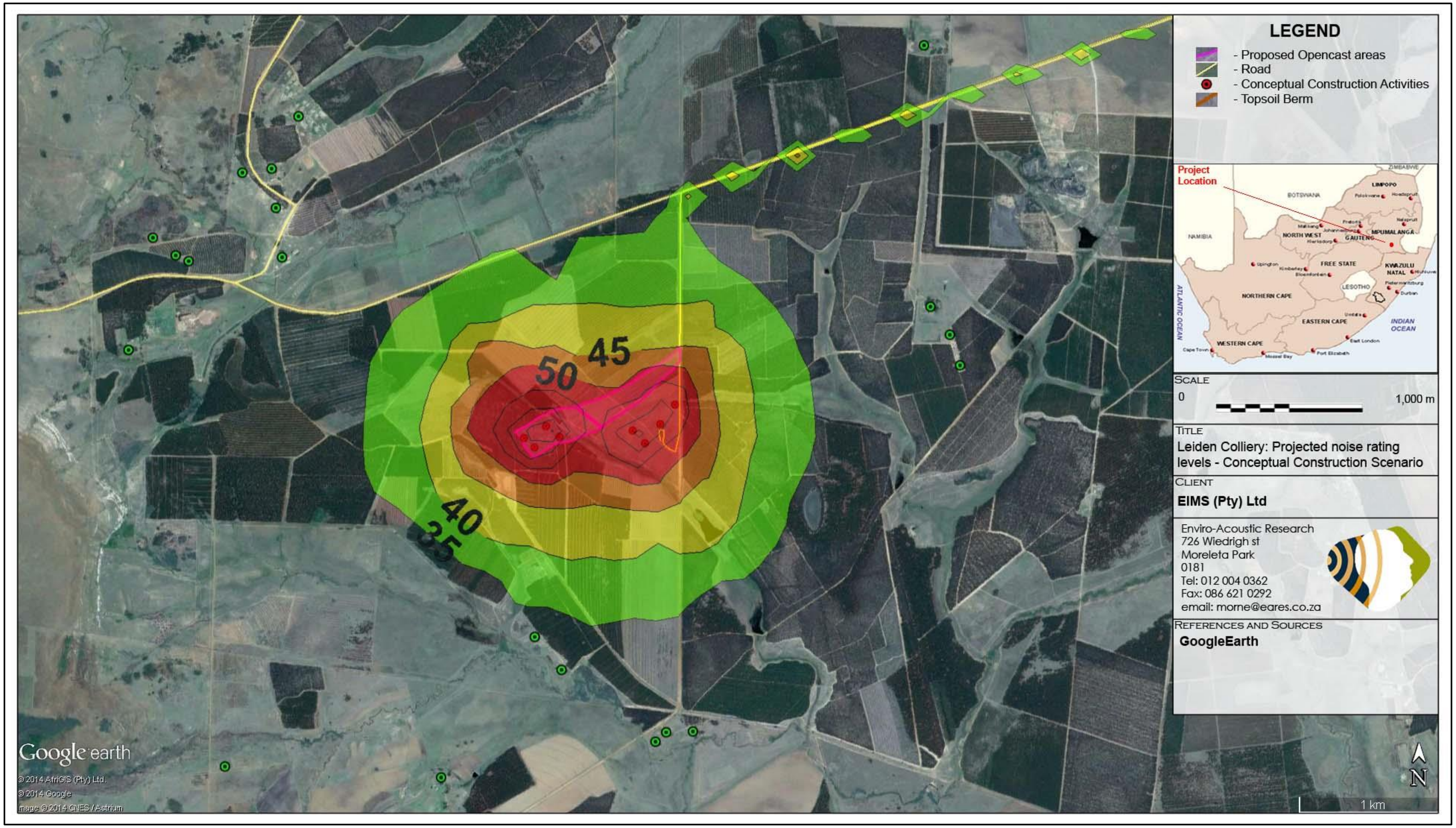


Figure 75: Projected total future night-time construction contours of noise levels

Calculations in this section are based on a worst-case scenario (all equipment operating simultaneously at maximum load) and will not be relevant for all times of the operations. The third octave sound power levels chosen for the modelled scenarios are presented in Description of modelled operational activities included:

- Meteorological conditions typical of night-time with temperature of 20^{o}C and humidity of 80%;
- A 5 m barrier that has been partly developed around the area where the future underground infrastructure will be developed;
- Mining activities within the expanded opencast area and the mining activities are more than 10 m deep (10 m highwall);
- A worst-case scenario was assessed, whereby the most significant noisy equipment functions simultaneously at full load for the entire night period;
- Receptors are regarded as 1.5 m height in relation to the surrounding environment and noise sources considered at 2 m with the crushing and screening activities located at 4 m from ground level; and
- Medium soft ground conditions (50% acoustically absorbent).

Projected Noise Levels in the area due to the opencast operational phase are illustrated in Figure 76 below.

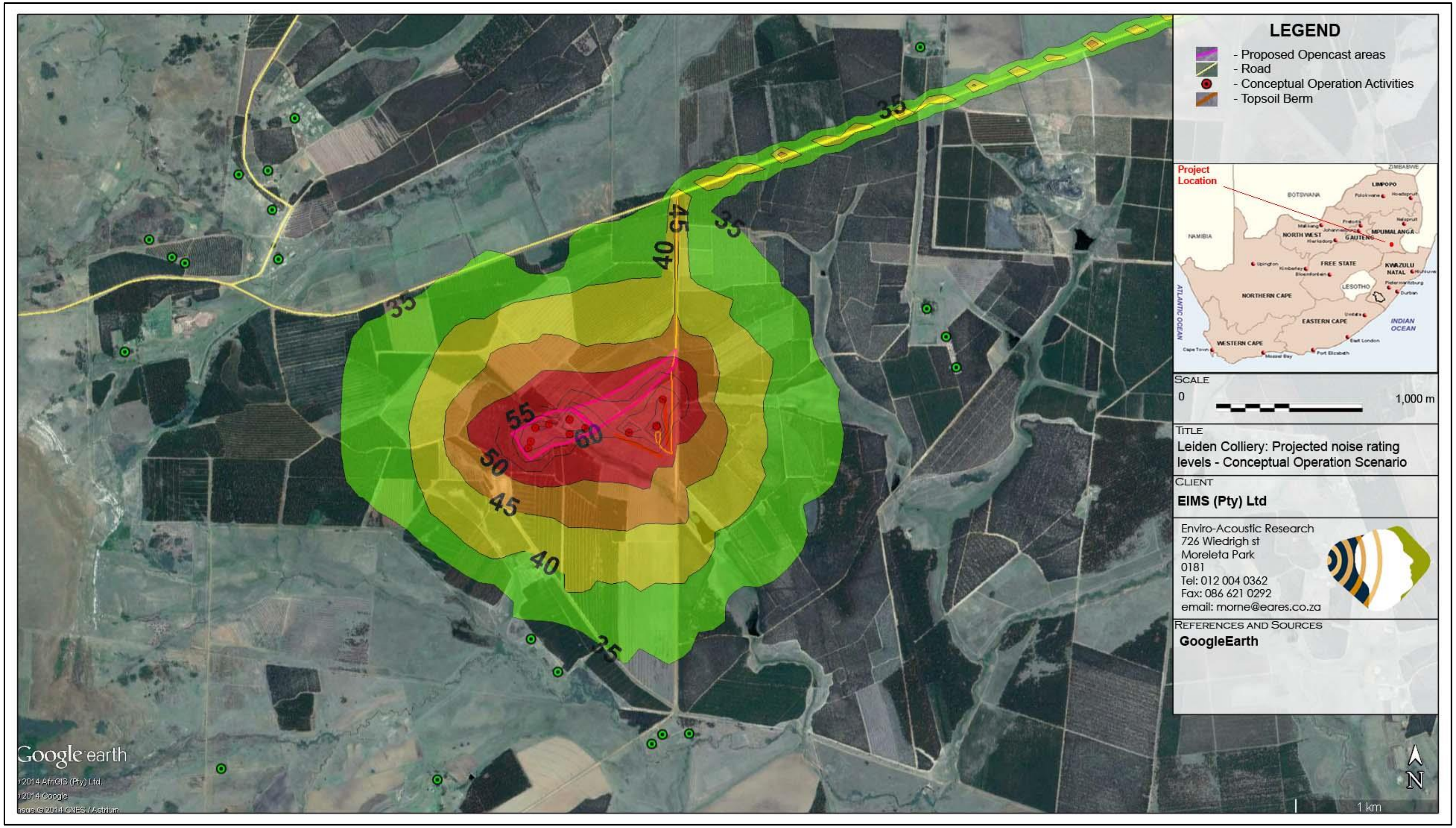


Figure 76: Projected total future night-time operational contours of noise levels – Opencast Mining

Calculations in this section are based on a worst-case scenario (all equipment operating simultaneously at maximum load) and will not be relevant for all times of the operations. Description of modelled operational activities included:

- Meteorological conditions typical of night-time with temperature of 20^{o}C and humidity of 80%;
- A 5 m topsoil barrier around most of the underground operation;
- Rehabilitation activities of the old mining opencast area;
- A worst-case scenario was assessed, whereby the most significant noisy equipment functions simultaneously at full load for the entire night period;
- Receptors are regarded as 1.5 m height in relation to the surrounding environment and noise sources considered at 2 m with the crushing and screening activities located at 4 m from ground level; and
- Medium soft ground conditions (50% acoustically absorbent).

Projected Noise Levels in the area due to the operational (underground) phase are illustrated in Figure 77 below.

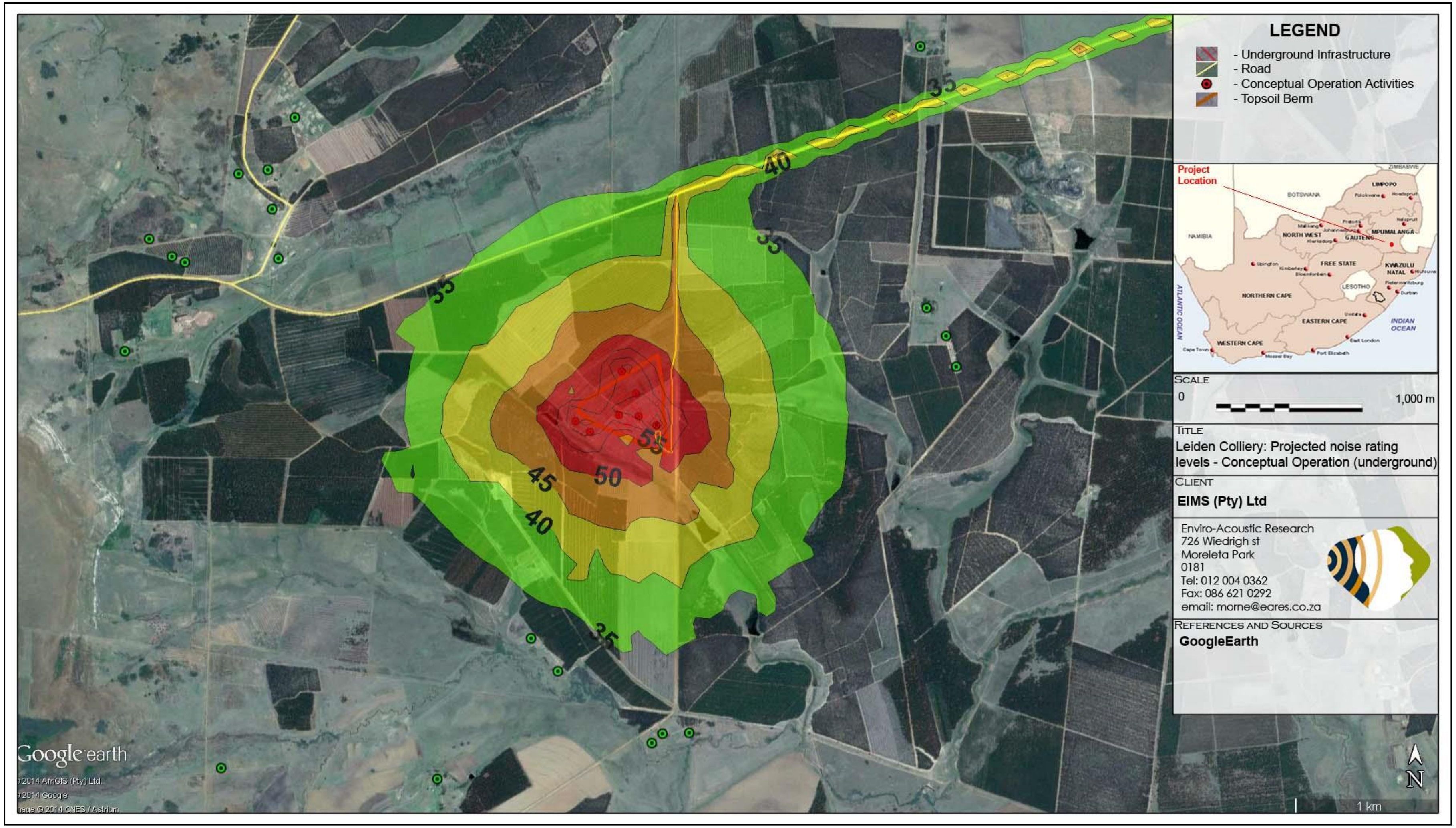


Figure 77: Projected total future night-time operational contours of noise levels - Underground Mining

The underground coal mining activity would introduce additional sounds to the predominantly agricultural community. The mining activity will most likely be audible at night during quiet periods, but the change in sound levels will be low, estimated to be less than 3 dB (closest receptors will know the activity is there). The noise levels will be slightly higher at the receptors staying east of the activity, but the magnitude of these levels will be insignificant and the significance of this noise impact is low.

7.15.7 CONCLUSION

The potential noise impact was evaluated using a sound propagation model. Conceptual scenarios were developed for both the construction and operational phases. Two different scenarios (Alternatives) were evaluated for the operational phase. The output of the modelling exercise indicated that there is a low significance for a noise impact to occur for both Alternatives. As the magnitude of the noise levels as well as the significance rating is similar for the two Alternatives there is no preferred alternative in terms of acoustics

7.16 BLASTING AND VIBRATION IMPACTS

The following is a summary of the noise and blasting impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.16.1 PLANNING AND DESIGN PHASE

No impacts have been identified for this phase.

7.16.2 CONSTRUCTION PHASE

No impacts have been identified for this phase.

7.16.3 OPERATION PHASE

7.16.3.1 Ground vibration Impact on houses

During the operational phase, blasting will be undertaken. The blasting has the potential to affect a houses structural integrity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	-2	-2	-2.3
Alternative 3 (Sensitivity planning approach)	-2	-2	-2.3

7.16.3.2 Ground vibration Impact on boreholes

During the operational phase, blasting will be undertaken. The blasting has the potential to affect a boreholes structural integrity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2	-2	-2.3
Alternative 3 (Sensitivity planning approach)	-2	-2	-2.3

7.16.3.3 Ground vibration Impact on roads

During the operational phase, blasting will be undertaken. The blasting has the potential to affect a roads structural integrity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-8.25	-2	-2.33
Alternative 3 (Sensitivity planning approach)	-2	-2	-2.33

7.16.3.4 Air blast Impact on houses

Air blast levels generated from blasting operations below 120 dB or greater magnitude toward critical areas where public is of concern. This will ensure that the minimum amount of disturbance is generated towards the critical areas surrounding the mining area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2	-2	-2.33
Alternative 3 (Sensitivity planning approach)	-2	-2	-2.33

7.16.3.5 Air blast Impact on boreholes

The impact of air blast on structures such as boreholes will be minimal as mitigation measures will ensure blasting operations are below 120 dB.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1.16
Alternative 3 (Sensitivity planning approach)	-1	-1	-1.16

7.16.3.6 Air blast Impact on roads

During the operational phase blasting will occur. One effect of blasting operations is the effects of air blast. Air blast must be kept to a minimum to reduce potential disturbances within the surrounding areas of the mine.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1.16

Alternative 3 (Sensitivity planning approach)	-1	-1	-1.16

7.16.3.7 Fly Rock Impact on houses

Blasting activities within large coal mines are designed to cast the blasted material much greater distances than in hard rock operation. This movement should be in the direction of the free face, and therefore the orientation of the blasting is important. Any rock travelling outside of this expected range is called fly rock. Fly rock can damage houses if the orientation of the blasting is miscalculated.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-2	-2	-2.33
Alternative 3 (Sensitivity planning approach)	-2	-2	-2.33

7.16.3.8 Fly Rock Impact on boreholes

Fly rock can damage boreholes if the orientation of the blasting is miscalculated.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1.25	-1.25	-1.45
Alternative 3 (Sensitivity planning approach)	-1.25	-1.25	-1.45

7.16.3.9 Fly Rock Impact on roads

Fly rock can damage roads if the orientation of the blasting is miscalculated.

Alternative	Pre-Mitigation	Post-	Final

	Score	Mitigation Score	Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-4	-4	-4.66
Alternative 3 (Sensitivity planning approach)	-4	-4	-4.66

7.16.3.10 Impact of Fumes - Houses

The chemical reaction and the nature of gases produced from the detonation of the explosives creates poisonous fumes such as nitrous oxides and carbon monoxide. These fumes are dangerous and harmful, and can affect human and animal health, households should not be exposed to these fumes. However due to the nature of the mining operations, this impact is unlikely to occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1.25	-1.25	-1.45
Alternative 3 (Sensitivity planning approach)	-1.25	-1.25	-1.45

7.16.3.11 Impact of Fumes - Boreholes

The chemical reaction and the nature of gases produced from the detonation of the explosives creates poisonous fumes such as nitrous oxides and carbon monoxide. These fumes are dangerous and harmful, and can affect human and animal health, households should not be exposed to these fumes. However due to the nature of the mining operations, this impact is unlikely to occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1.16
Alternative 3 (Sensitivity planning approach)	-1	-1	-1.16

7.16.3.12 Impact of Fumes - Roads

The chemical reaction and the nature of gases produced from the detonation of the explosives creates poisonous fumes such as nitrous oxides and carbon monoxide. These fumes are dangerous and harmful, and can affect human and animal health, households should not be exposed to these fumes. However due to the nature of the mining operations, this impact is unlikely to occur.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-1	-1	-1.16
Alternative 3 (Sensitivity planning approach)	-1	-1	-1.16

7.16.4 DECOMMISSIONING PHASE

No impacts have been identified for this phase.

7.16.5 REHABILITATION AND CLOSURE PHASE

No impacts have been identified for this phase.

7.16.6 ALTERNATIVE IMPACT DISCUSSION

Presented are simulations for expected ground vibration levels from the expected charge mass as would be expected for the opencast blasting operations for Alternative 2. Figure 78 shows the contour levels for the expected ground vibration at distances from the opencast pit area. Figure 79 shows the contour levels for the expected air blast at distances from the box-cut area.

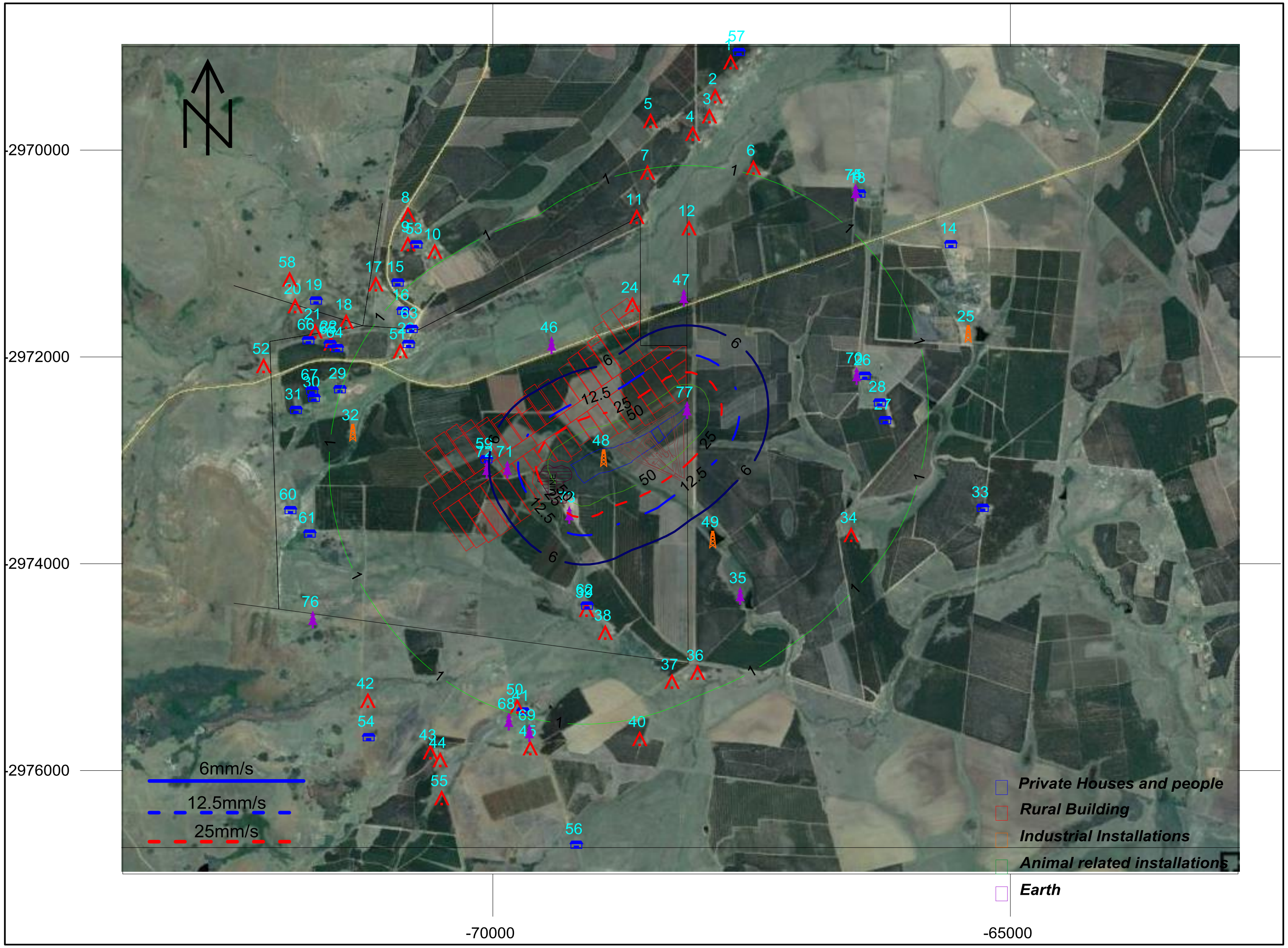


Figure 78: Alternative 2 ground vibration levels

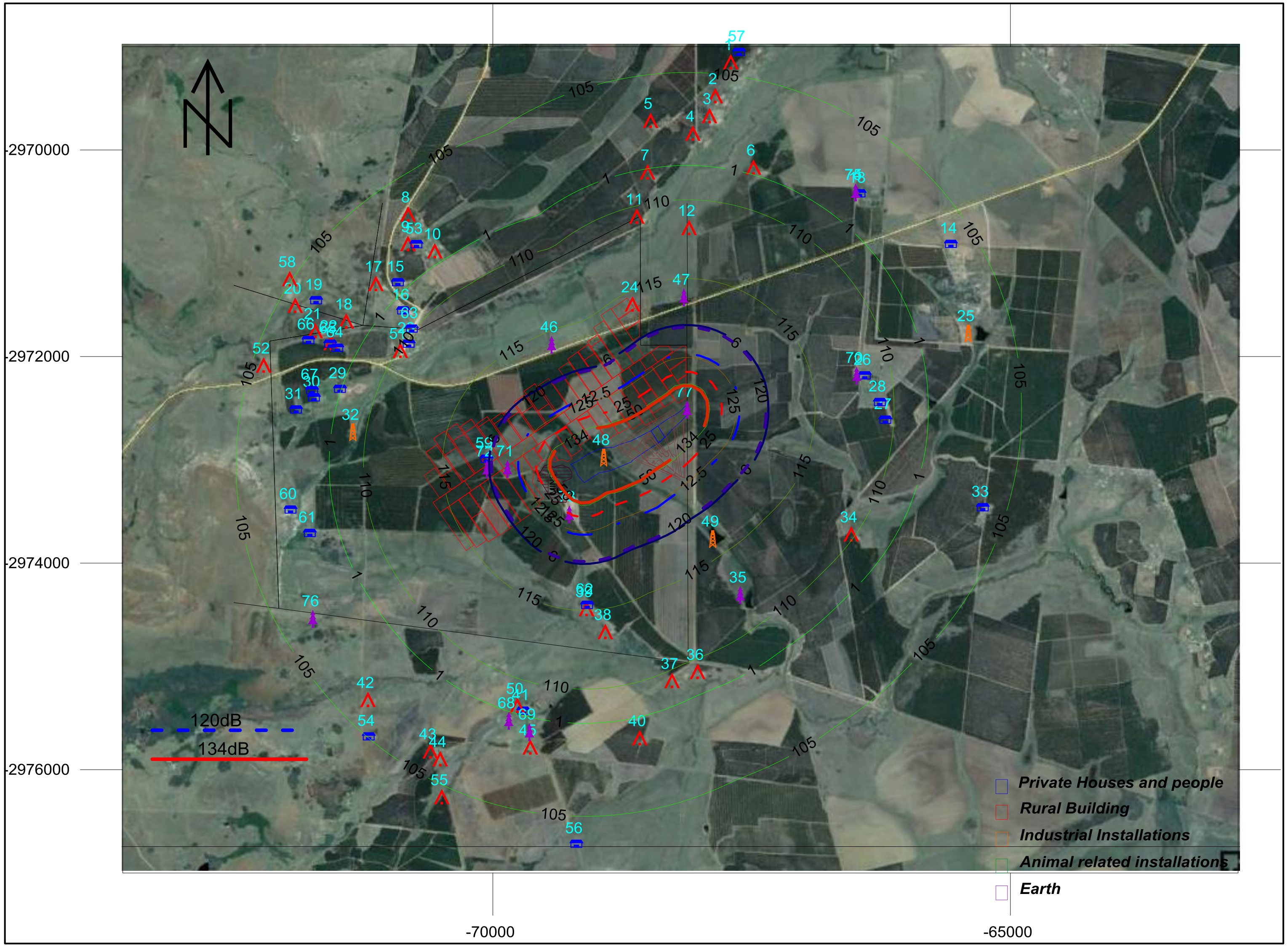


Figure 79: Alternative 2 air blast

Presented are simulations for expected ground vibration levels from the expected charge mass as would be expected for the box-cut blasting operations for Alternative 3. Figure 80 shows the contour levels for the expected ground vibration at distances from the box-cut area. Figure 81 shows the contour levels for the expected air blast at distances from the box-cut area.

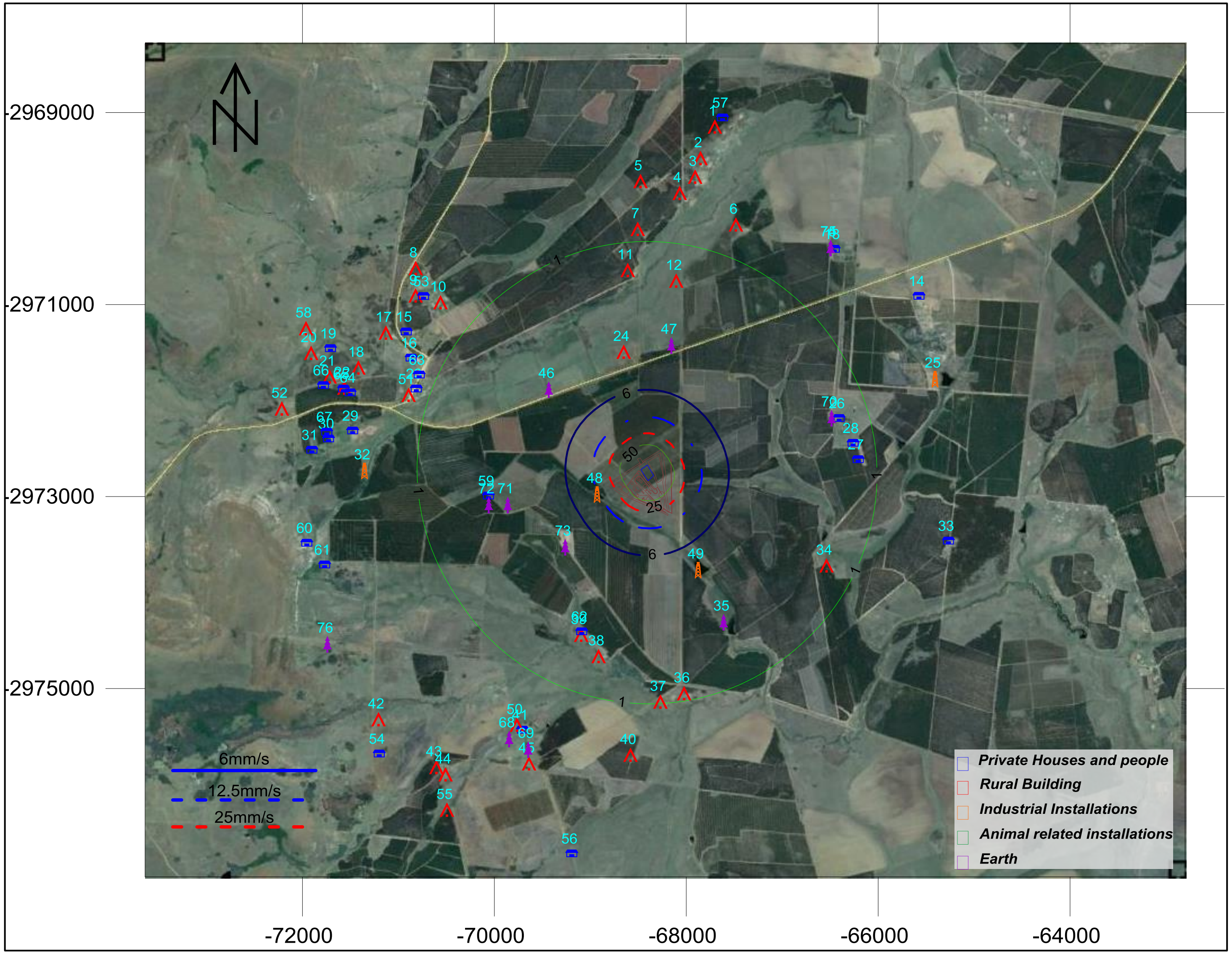


Figure 80: Alternative 3 ground vibration levels

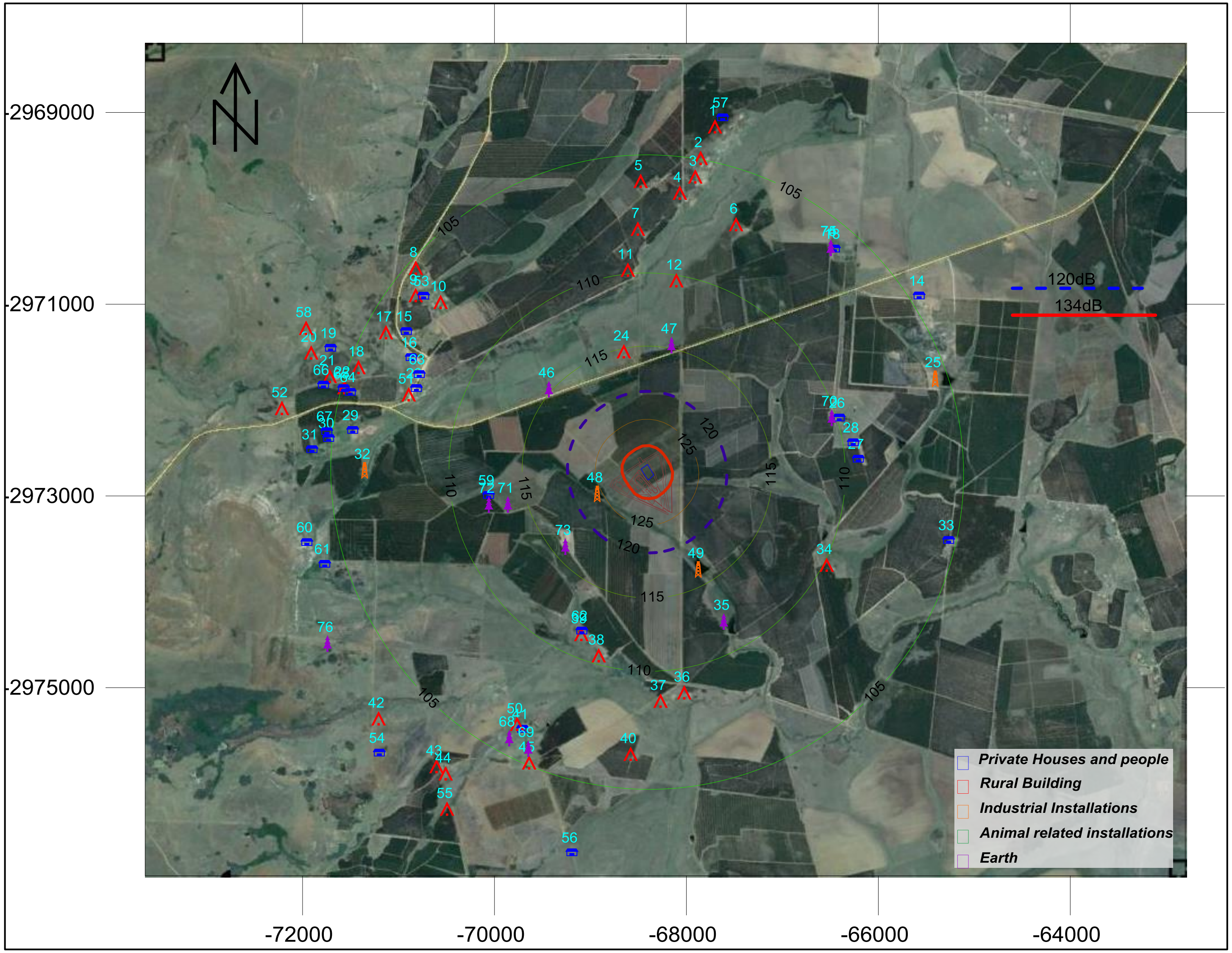


Figure 81: Alternative 3 air blast

Blasting operations in the underground mining operation needs to be considered as well. The expected charge mass per delay is significant lower than for the box-cut development. A maximum charge per delay of 4kg is planned. The charge per blast hole is the maximum that may be allowed in a blast hole for underground coal mining. This is a set limitation for fiery mines. The expected worst case scenario calculates a ground vibration level of 1.8 mm/s at a distance of 100 m. There are various factors that will influence on this level. The characteristics of shock waves from underground blasting are changed by the different interfaces and geology structures. It is very certain that the predicted level of 1.8 mm/s at 100 m will not be reached but without actual measurements yet in this area it is safe to assume the maximum possible will be the 1.8 mm/s. Review of the underground plan and surface structures in relation to the workings showed POI 24 and 59 located above the underground workings. These Poi's represent ruins and a grave yard site. The expected levels at these points are less than allowed limits. At a depth of 40 m the maximum possibly expected is in the order of 8.2 mm/s. These levels are well within accepted norms. There are Hydro census boreholes also located on the workings at POI 71 and 72. These boreholes will certainly be used for alternative uses as mining progress into the area of the boreholes. The expected influence with regards to ground vibration from underground mining is low.

The three development alternatives are discussed below.

Table 32: Alternatives comparison

Alternative comparison			
Aspect Considered	Alternative 1	Alternative 2	Alternative 3
Ground vibration Impact on houses	No Influence	No Influence Expected	No Influence Expected
Ground vibration Impact on boreholes	No Influence	No Influence	No Influence
Ground vibration Impact on roads	No Influence	Influence expected	No Influence
Air blast Impact on houses	No Influence	No Influence	No Influence
Air blast Impact on boreholes	No Influence	No Influence	No Influence
Air blast Impact on roads	No Influence	No Influence	No Influence
Fly Rock Impact on houses	No Influence	No Influence	No Influence
Fly Rock Impact on boreholes	No Influence	No Influence	No Influence
Fly Rock Impact on roads	No Influence	Influence expected	No Influence

Alternative comparison			
Aspect Considered	Alternative 1	Alternative 2	Alternative 3
Impact of Fumes - Houses	No Influence	No Influence	No Influence
Impact of Fumes - Boreholes	No Influence	No Influence	No Influence
Impact of Fumes - Roads	No Influence	No Influence	No Influence
Monitoring	None	Long Term Monitoring Suggested	Short Term Monitoring Suggested
Safe Blasting Distance	None applicable	Minimal closure of road for traffic during blasting operations in box-cut	Minimal closure of road for traffic during blasting operations in box-cut
Structure Inspection	None applicable	Nearest houses is 1459 m. No inspections specifically recommended. Due to long term operation inspection may prove valuable for future claims.	Nearest houses is 1757 m. No inspections specifically recommended
Safe blasting times	None	As per recommendation	As per recommendation
Limits: Ground Vibration and air blast	None	As per recommendation	As per recommendation

In both case for Alternative 2 and 3 is the final objective an underground mine where the opencast and box-cut will be used for access. The evaluation of effects yielded by blasting operations for in Alternative 2 and 3 was evaluated over an area as wide as 3500m at least and in some cases further from the mining area considered. The range of structures expected is typical farming community with structures that range from well build to informal building style. These include rural type mud house buildings to brick and mortar structures, cement brick structures, and industrial structures.

The project area has possibility of presence of people and farm animals at close proximity of the operations. There are minimal structures within 500 m of the opencast and box-cut area. There is two POI's identified on surface above the underground workings. All animals and people should not be present within 500 m from the opencast mine area or the box-cut blasting operations.

Alternative 2 charge mass evaluated showed influence on the surrounding area mainly on the gravel road on the eastern side. Due to location of road in relation to the pit area levels of ground vibration are higher than the limit for the road. Air blast is well within accepted norms. No other structure or point of interest showed levels of concern. Should the blast design change from the data submitted in this report then re-evaluation of ground vibration can be done.

Fly rock calculated showed distances up to 311 m is well possible. Clearance from blasting should be at least 311 m. There are also no surface structures within this distance other than the gravel road.

Alternative 3 charge mass evaluated showed minimal influence on the surrounding area due to location of structure in relation to the box-cut area. Levels of ground vibration and air blast are well within accepted norms. No specific mitigations are required at this stage. Should the blast design change from the data submitted in this report then re-evaluation of ground vibration can be done.

Fly rock calculated showed distances up to 311 m is well possible. Clearance from blasting should be at least 311 m. There are also no surface structures within this distance. Only the access road on the eastern side of the box-cut falls within this range.

7.16.7 CONCLUSION

From a blasting and vibration perspective, Alternative 3 is preferred in terms of proximity of sensitive receptors and the degree of impact of activities on these receptors.

7.17 TRAFFIC IMPACTS

The following is a summary of the traffic impacts likely to occur during the project. Each listed impact has been assessed and assigned a significance score. The impacts for each of the four project development Alternatives for each project phase are included for comparative purposes. For the full impact assessment calculations please refer to Appendix A.

7.17.1 PLANNING AND DESIGN PHASE

7.17.1.1 Impact on Adjacent Road Network

Adjacent road networks will potentially be affected by the mining development and its associated trucks using the haul and main roads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5.5	-5	-8.33
Alternative 3 (Sensitivity planning	-5.5	-5	-8.33

approach)			

7.17.1.2 Impacts on Links and Intersections

The N2, gravel road 1 and 2 might be directly affected by new traffic generated by the proposed mining development.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5.5	-5	-8.33
Alternative 3 (Sensitivity planning approach)	-5.5	-5	-8.33

7.17.1.3 Impacts on Bridges and Culverts

Increased traffic volumes on current river crossing infrastructure will negatively impact the structures by their increased use.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5.5	-5	-8.33
Alternative 3 (Sensitivity planning approach)	-5.5	-5	-8.33

7.17.1.4 Impacts on Communities

Safety concerns have been raised with the potential increased traffic volumes and the presence of two schools in the area. However, during the planning phase this impact will be minimal.

Alternative	Pre-Mitigation Score	Post-Mitigation	Final Significance

		Score	
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-5.5	-5	-8.33
Alternative 3 (Sensitivity planning approach)	-5.5	-5	-8.33

7.17.2 CONSTRUCTION PHASE

7.17.2.1 Impact on Adjacent Road Network

Adjacent road networks will be affected by the mining development and its associated trucks using the haul and main roads. Increased levels of trucks will be utilizing the road network in the surrounding areas during the construction phase bringing materials for construction onto site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10.5	-9.75	-16.25
Alternative 3 (Sensitivity planning approach)	-9.75	-9	-15

7.17.2.2 Impacts on Links and Intersections

The N2, gravel road 1 and 2 might be directly affected by new traffic generated by the proposed mining development.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10.5	-9.75	-16.25

Alternative 3 (Sensitivity planning approach)	-9.75	-9	-15

7.17.2.3 Impacts on Bridges and Culverts

Increased traffic volumes on current river crossing infrastructure will negatively impact the structures by their increased use. Potential upgrades to this infrastructure may be required to support the operational phase truck loads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10	-9.75	-16.25
Alternative 3 (Sensitivity planning approach)	-9.75	-9	-15

7.17.2.4 Impacts on Communities

Safety concerns have been raised with the potential increased traffic volumes and the presence of two schools in the area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-10.5	-9.75	-16.25
Alternative 3 (Sensitivity planning approach)	-9.75	-9	-15

7.17.3 OPERATION PHASE

7.17.3.1 Impact on Adjacent Road Network

Adjacent road networks will be affected by the mining development and its associated trucks using the haul and main roads. Increased levels of trucks will be utilizing the road network in the surrounding areas during the operational phase due to the transportation of coal offsite to the Delta plant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11.25	-10.5	-17.5
Alternative 3 (Sensitivity planning approach)	-10.5	-9.75	-16.25

7.17.3.2 Impacts on Links and Intersections

The N2 and gravel road 2 will be directly affected by new traffic generated by the proposed mining development as the trucks move the coal offsite to the Delta Plant. The operation phase will see the highest significance of this impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11.25	-10.5	-17.5
Alternative 3 (Sensitivity planning approach)	-10.5	-9.75	-16.25

7.17.3.3 Impacts on Bridges and Culverts

Increased traffic volumes on current river crossing infrastructure will negatively impact the structures by their increased use. Potential upgrades to this infrastructure may be required to support the operational phase truck loads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	-11.25	-10.5	-17.5
Alternative 3 (Sensitivity planning approach)	-10.5	-9.75	-16.25

7.17.3.4 Impacts on Communities

Safety concerns have been raised with the potential increased traffic volumes and the presence of two schools in the area. However, the trucks hauling the coal offsite will have scheduled movements and be monitored by speed limits to reduce this impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-11.25	-10.5	-17.5
Alternative 3 (Sensitivity planning approach)	-10.5	-9.75	-16.25

7.17.4 DECOMMISSIONING PHASE

7.17.4.1 Impact on Adjacent Road Network

Adjacent road networks will be affected by the mining development and its associated trucks using the haul and main roads. Increased levels of trucks will be utilizing the road network in the surrounding areas during the decommissioning phase removing materials from the site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-5	-8.33
Alternative 3 (Sensitivity planning approach)	-5	-4.5	-7.5

7.17.4.2 Impacts on Links and Intersections

The N2, gravel road 1 and 2 might be directly affected by new traffic generated by the proposed mining development.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-5	-8.33
Alternative 3 (Sensitivity planning approach)	-5	-4.5	-7.5

7.17.4.3 Impacts on Bridges and Culverts

Increased traffic volumes on current river crossing infrastructure will negatively impact the structures by their increased use.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-7.5	-5	-8.33
Alternative 3 (Sensitivity planning approach)	-5	-4.5	-7.5

7.17.4.4 Impacts on Communities

Safety concerns have been raised with the potential increased traffic volumes and the presence of two schools in the area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0

Alternative 2 (Maximum mine production)	-7.5	-5	-8.33
Alternative 3 (Sensitivity planning approach)	-5	-4.5	-7.5

7.17.5 REHABILITATION AND CLOSURE PHASE

7.17.5.1 Impact on Adjacent Road Network

Adjacent road networks may potentially be affected by the mining development and its associated trucks using the haul and main roads. During the rehabilitation phase however, traffic volumes will be minimal.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-4.5	-4	-6.66
Alternative 3 (Sensitivity planning approach)	-4	-3.5	-5.83

7.17.5.2 Impacts on Links and Intersections

The N2, gravel road 1 and 2 may potentially be affected by traffic generated by the proposed mining development. This impact will however be temporary during the rehabilitation phase.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-4.5	-4	-6.66
Alternative 3 (Sensitivity planning approach)	-4	-3.5	-5.83

7.17.5.3 Impacts on Bridges and Culverts

Increased traffic volumes on current river crossing infrastructure will negatively impact the structures by their increased use. However if the infrastructure is upgraded prior to the operational phase this impact will be low.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-4.5	-4	-6.66
Alternative 3 (Sensitivity planning approach)	-4	-3.5	-5.83

7.17.5.4 Impacts on Communities

Safety concerns have been raised with the potential increased traffic volumes and the presence of two schools in the area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-4.5	-4	-6.66
Alternative 3 (Sensitivity planning approach)	-4	-3.5	-5.83

7.17.6 ALTERNATIVE IMPACT DISCUSSION

Due to the sensitivity receptors in close proximity of Gravel Road 1 it has been decided that Gravel Road 2 is preferred as the best alternative to access the mine. There is no difference between the two development Alternatives, Alternative 2 and Alternative 3, from a traffic perspective.

7.17.7 CONCLUSION

It is recommended that Gravel Road 2 be considered as the best Alternative to provide access to the Leiden mine. There is no difference between the two development Alternatives, Alternative 2 and Alternative 3, from a traffic perspective. Based on the conclusions of this assessment, it is recommended that the proposed development should be favourably considered from a traffic engineering point of view by the relevant authorities.

7.18 RESIDUAL IMPACTS POST CLOSURE

The following significant impacts have been identified by the specialists as residual impacts post closure which require management.

- Decant; and
- Acid Mine Drainage

7.18.1 GROUNDWATER CONTAMINANT PLUME

Once the mining has ceased, ARD is still likely to form in the facility. Therefore a groundwater contaminant plume is likely to migrate from the mining area once the water level in the workings have reached long term steady state conditions. The contaminant plume emanating from the underground will move in a south easterly direction. The plume is likely to extend ~500m to the south east after 50 years post closure. After 100 years post closure the plume is likely to have migrated 700-1000m south east. The contaminant concentration is likely to increase over time as the plume develops.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-21.25	-21.25	-42.5
Alternative 3 (Sensitivity planning approach)	-13	-12	-16

7.18.2 DECANT FROM UNDERGROUND

Decanting occurs when the mine water level in the underground workings rebounds to a level above the topographic elevation, resulting in mine water discharging onto surface. Surface decanting refers to direct discharge of mine water to surface through backfilled boxcut material. Decant take place at the lowest topographic level that intersects the flow path and/or mine workings.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alternative 1 (No-go)	0	0	0
Alternative 2 (Maximum mine production)	-23.75	-23.75	-47.5
Alternative 3 (Sensitivity planning approach)	-21.25	-18.75	-37.5

8 LIST OF SIGNIFICANT IMPACTS IDENTIFIED

As a result of the impact assessment undertaken in Section 7 a detailed list of significant impacts is provided below and for each project phase. The selection criteria for impacts deemed “significant” is simply the final score calculated post mitigation and with the addition of the prioritisation factors described in the assessment methodology. The list includes significant positive and negative impacts applicable to all alternatives.

8.1 SIGNIFICANT PRE-CONSTRUCTION PHASE IMPACTS

- Social expectations
- Social licence to operate (positive)
- Employment addition to economy (positive)

8.2 SIGNIFICANT CONSTRUCTION PHASE IMPACTS

- Health impacts
- Social vices
- Crime and violence
- Employment addition to economy (positive)
- Acid Mine Drainage
- Acid mine drainage effects on surrounding ecosystems
- Erosion at river crossings (haul roads)
- Clearing topsoil for footprint areas
- Ground water quality

8.3 SIGNIFICANT OPERATION PHASE IMPACTS

- Dust from a nuisance and livelihood perspective
- Impacts associated with the transport of workers
- Blasting and vibration from a social perspective
- Crime and violence
- Economic impacts (positive)
- Relocations
- Annual GDP (positive)
- AMD
- AMD effects on surrounding ecosystems
- Acids downstreams effects
- Acids effects on water chemistry
- Chemical precipitates
- Acid management measures

- Environmental liability
- Poor acid conditions
- Acidification of surface water
- Water quality impacts due to spills/leaks and stormwater
- Water impacts due to runoff and erosion
- Water impacts due to major spills (fuel and sewage)
- Flow modification (subsidence and open cast mining)
- Loss of sensitive species and decline in biodiversity
- Cumulative impacts
- Dewatering
- Reduction in streamwater baseflow
- Ground water quality
- Nuisance dust fall

8.4 SIGNIFICANT DECOMMISSIONING PHASE IMPACTS

- Loss of jobs and economic opportunities
- Re instatement of livelihoods (positive)
- Decrease in GDP
- AMD
- Acids downstreams effects
- Acids effects on water chemistry
- Chemical precipitates
- Acid management measures
- Environmental liability
- Poor acid conditions
- Erosion
- Water quality (seepage and AMD)
- Water quality deterioration related to spills/leaks
- Loss of sensitive species and decline in biodiversity
- Ground water contamination plume
- Contaminated groundwater seepage to streams (salt load)
- Decant from underground water

8.5 SIGNIFICANT REHABILITATION AND CLOSURE PHASE IMPACTS

- Social expectations
- Social licence to operate (positive)
- AMD
- AMD effects on surrounding ecosystems

- Acids downstreams effects
- Acids effects on water chemistry
- Chemical precipitates
- Acid management measures
- Environmental liability
- Poor acid conditions
- Water quality – decant and AMD
- Decrease in water quality due to Ingress
- Biodiversity losses and decline in biotic integrity
- Cumulative impacts
- Ground water contamination plume
- Contaminated groundwater seepage to streams (salt load)
- Decant from underground water

8.6 SIGNIFICANT RESIDUAL IMPACTS POST CLOSURE

Residual impacts are those impacts that despite reducing the probability and consequence might still occur, namely: Decant and Acid Mine Drainage.

9 STAKEHOLDER ENGAGEMENT

9.1 LEGAL COMPLIANCE

The Public Participation Process must comply with the three important sets of legislation that require public participation as part of an application for authorisation or approval; namely:

- The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002);
- The National Environmental Management Act (Act No. 107 of 1998); and
- The National Water Act (Act No. 36 of 1998)

Adherence to the requirements of the above mentioned Acts will allow for an Integrated Public Participation Process to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts. The details of the Integrated Public Participation Process are provided below.

9.1.1 GENERAL APPROACH TO SCOPING AND PUBLIC PARTICIPATION

The PPP for the proposed Leiden project has been undertaken in accordance with the requirements of the MPRDA, NEMA, and NWA, in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&AP's are afforded an opportunity to comment on the project.

9.2 PUBLIC PARTICIPATION METHODOLOGY

The Public Participation Process (PPP) is a requirement of several pieces of South African Legislation and aims to ensure that all relevant Interested and Affected Parties (I&AP's) are consulted, involved and their opinions are taken into account and a record included in the reports submitted to Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed Leiden coal mine needs to be managed sensitively and according to best practises in order to ensure and promote:

- Compliance with international best practise options;
- Compliance with national legislation;
- Establish and manage relationships with key stakeholder groups; and
- Encourage involvement and participation in the environmental study and authorisation/approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Introduce the proposed Leiden project;

- Explain the environmental authorisations required;
- Explain the environmental studies already completed and yet to be undertaken;
- Determine and record issues, concerns, suggestions, and objections to the project;
- Provide opportunity for input and gathering of local knowledge;
- Establish and formalise lines of communication between the I&AP's and the project team;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent environmental impacts associated with the project.

9.3 IDENTIFICATION OF I&AP'S

An initial I&AP list was compiled using WinDeed searches to determine the registered landowners of the project affected land parcels. The I&AP list was compiled containing the following categories of stakeholders:

- National Government;
- Provincial Government;
- Local Government;
- Agricultural Sector;
- Organised Business;
- Host and Adjacent Communities;
- Land Claimants;
- Other organisations, clubs, communities, and unions; and
- Various NGO's.

9.3.1 LIST OF AUTHORITIES IDENTIFIED AND NOTIFIED

The following authorities have been identified and notified of the proposed Leiden Coal Mine:

- Department of Mineral Resources (DMR);
- Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET);
- Department of Environmental Affairs (DEA);
- Department of Water Affairs (DWA);

- The Mpumalanga Department of Agriculture, Rural Development and Land administration (DARDLA);
- Mkhondo Local Municipality;
- Mpumalanga Department of Roads and Transport;
- Mpumalanga Tourism and Parks Board;
- The South African Heritage Resources Agency (SAHRA); and
- The South African National Roads Agency Limited (SANRAL).

9.3.2 LIST OF KEY STAKEHOLDERS IDENTIFIED AND NOTIFIED

Please see Appendix S for the complete key stakeholder database.

9.3.3 LIST OF SURFACE RIGHTS HOLDERS/LANDOWNERS IDENTIFIED AND NOTIFIED

The following surface rights/landowners of the area under application have been identified and notified of the proposed Leiden Coal Mine:

- Le Roux van Niekerk

In addition to the surface rights/landowners of properties within the application area, surface rights holders/landowners within the surrounding area were also identified and notified of the proposed Leiden Coal Mine. For a full list of the surrounding landowners identified and notified please refer to Appendix S.

9.4 NOTIFICATION OF I&AP'S

I&AP's identified were notified of the proposed Leiden Coal Mine on the 25th of April 2014 and in the following manner. For proof of notification please refer to Appendix S.

9.4.1 REGISTERED LETTERS, FAXES, AND EMAILS

From the above mentioned list of I&AP's and stakeholders, notification documents were drafted and sent via registered post, facsimile, and e-mail on 25th April 2014, including the purpose of the project, the mining method to employed, the mineral to be mined, the details of the area under application, the three environmental processes and approvals required and date by which registration and comment must be provided. The notification also included information on where to review the draft scoping report and the date, place and time on which the initial public open day was scheduled. The notification document included a Background Information Document (BID), the details of which are provided below. Please refer to Appendix S for proof of this notification.

All registered I&AP's were notified of the availability of the draft IEMPR for review on. the 10th of September 2014 through registered mail, fax, and email.

9.4.2 SITE NOTICES

A2 laminated site notices were placed along and within the perimeter of the proposed project area on 24th April 2014. The on-site notices included the following information:

- Project name;
- Applicant name;
- Project location;
- Map of proposed project area;
- Closest town;
- Mine description;
- Project description;
- Legislative requirements;
- Details of the first public open day to be held for the project; and
- Relevant EIMS contact person for the project.

Please refer to Appendix S for proof of site notice placement.

9.4.3 POSTERS

A3 Posters were also placed around the proposed project area on 24th April 2014. The posters included the following information:

- Project name;
- Applicant name;
- Project location;
- Map of proposed project area;
- Closest town;
- Mine description;
- Project description;
- Legislative requirements;
- Details of the first public open day to be held for the project; and
- Relevant EIMS contact person for the project.

Please refer to Appendix S for proof of site notice placement.

9.4.4 BACKGROUND INFORMATION DOCUMENTS

Included in the I&AP notification letters, facsimiles, and e-mail was a BID. The BID included the following information:

- Project introduction;
- Aim of the BID;
- Project description;
- Location and extent of the project;
- Legislative requirements;
- Summary of the PPP;
- Information on document review;
- A detailed questionnaire;
- I&AP registration form; and
- Details on the first public open day to be held for the project.

Please refer to Appendix S for proof of the BID issued to I&AP's.

9.4.5 NEWSPAPER ADVERTISEMENTS

Two advertisements were placed in newspapers with adequate circulation in the area. The advertisements were placed in the Beeld on 24th April 2014 and in the Highveld Tribune on 29th April 2014. The newspaper adverts included the following information:

- Project name;
- Applicant name;
- Project location;
- Closest town;
- Mine description;
- Project description;
- Legislative requirements;
- Details of the first public open day to be held for the project; and
- Relevant EIMS contact person for the project.

9.5 PUBLIC PARTICIPATION OPEN DAYS

In addition to the notification document, two Public Participation Open Days were scheduled at the Ermelo Country Club.

9.5.1 INTRODUCTORY OPEN DAY

The first Public Open Day was held on 19 June 2014 at the Ermelo Country Club and was aimed at introducing I&AP's to the proposed project, explaining the process going forward and providing them opportunity to comment on the Draft Scoping Report. Five (5) I&AP's attended the open day. The attendees consisted of a ward councillor, landowners and other I&AP's within the area. The main issues that were raised were the following; a) In terms of job opportunities, when will the mine be scheduled to commence, b) Has there been interest in the mine with I&AP's commenting on the project, c) Are there any homes located within the zone of influence with respect to the blasting and vibration that is to commence, d) Where is the mine located and e) The landowners are satisfied with the information that has been provided for the project and inquired as to what EIMS's opinion was regarding the granting of the mining right. All comment and curriculum vitiate received after the 8th of July are included in this Integrated EMPR.

9.5.2 SECOND OPEN DAY

A second Public Open Day will be held on the 15th of October 2014 at the Ermelo Country Club to discuss the findings of the EIA investigation and to solicit further comment, concerns, suggestions or objections from I&AP's for inclusion into the document. I&AP's will also be provided a period in which to comment on the Draft IEMPR Report prior to submission. All comment received during the second public open day will be included in the final IEMPR to be submitted to the DMR, MDEDET, and DEA for decision making purposes.

9.6 ISSUES AND RESPONSES

The issues and responses below are those that have been provided and addressed up until the 10th of September 2014.

9.6.1 HOW ISSUES RAISED WERE ADDRESSED

Issues raised were addressed in a transparent manner and included in the compilation of the EIA and EMP for the proposed Leiden Coal mine in the following manner:

- Issues raised were used quantitatively to calculate the significance of impacts both real and perceived;
- Issues raised were used to provide further suggestions and recommendations with regard to technical management options for impacts;
- Issues raised were used to develop suitable project alternatives; and
- Issues raised were used to direct specialist studies

I&AP's issues, comments, concerns and other information were used not only to develop the EIA and EMP, but to describe the baseline receiving environment including current land uses as well. All information requests by I&AP's were also honoured by the EAP.

9.6.2 SUMMARY OF THE ISSUES AND RESPONSES

The table below is a summary of the issues raised by I&AP's and the corresponding response by the EAP.

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
Jenna Lavin	SAHRA	Heritage	Email/ online submission	30/04/2014	1. SAHRA thanked EIMS for informing them of the proposed development of the underground and opencast coal mine. SAHRA indicated that no heritage feature may be removed or disturbed without permit. If any site is to be disturbed a HIA must be conducted to assess the potential impacts and develop related mitigation measures. SAHRA. SAHRA provided interim comment stating that: The final report is to include a map with identified resources, heritage significance ratings, include examples of palaeontological sensitivity for the area and include examples of potential fossils likely to be impacted on, a suitably qualified palaeontological specialist must conduct a site inspection prior to excavations once the overburden has been removed, should the site yield significant paleo-botanical specimens further site inspections must be	1. EIMS responded by thanking Ms Lavin for the interim comment and stated that the requirements will be addressed during the EIA phase.	A full Heritage Impact Assessment will be undertaken by Professional Grave Solutions (Pty) Ltd (PGS) during the EIA phase. Copies of the Heritage assessment and the EIA will be provided to SAHRA for review.

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					arranged between the geologist and palaeontologist. The final heritage impact assessment must satisfy SAHRA's minimum requirements for impacts assessments and must comply with NHRA and provide mitigation measures for potential impacts.		
Andre Eagar	National DMR	Authority notification	Email	24/04/2014	1. Mr Eagar requested that the notification document be forwarded on to the regional DMR department.	1. EIMS responded to Mr Eagar informing him that a notification was sent to the regional DMR at the same as the National DMR. EIMS requested any contact details for the Regional DMR that Mr Eagar would recommend.	EIMS is in the process of contacting the regional DMR. The regional DMR has however been sent a letter via registered mail in the meantime.
Dumisani Shabangu	I&AP	Job enquiry	Email	5/05/2014 2/06/2014	1. Mr Shabangu stated that he is a resident on the Leiden Farm and that he is interested in a job if the mine would be interested in hiring him. 2. Mr Shabangu enquired if anyone would be allowed to attend the meeting and would those that can't attend be provided with meeting minutes?	1. Mr Shabangu was thanked for his interest in the project. EIMS indicated that it is undertaking the environmental assessment on behalf of the mine and as such EIMS is not involved in the employment process. The mine has an employment and procurement policy that they will follow, however EIMS will	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
				21/06/2014 27/06/2014	3. Mr Shabangu contact EIMS with regards to the public open day and enquired as to what happened at the meeting. 4. Mr Shabangu replied stating that he looks forward to the open day minutes. 5. Mr Shabangthanked EIMS for the Open day minutes and requested that he be notified if anything changes regarding the project to let him know.	forward Mr Shabangu's request and information to the applicant. 2. EIMS explained to Mr Shabangu that EIMS would be holding a Public Open Day and not a meeting. The objective of the open day is to provide I&AP the opportunity to meet with the environmental consultants and acquire more information about the proposed project. EIMS also stated that anyone is able to attend this open day and if there are major issues raised at the public open day I&AP will be notified of these. 3. EIMS responded to Mr Shabangu and stated that the open day minutes are currently being drafted and will be sent to him once they are completed. 4. EIMS sent Mr Shabangu the open day minutes for him to review.	
Bongani	I&AP	Job enquiry	Email	4/05/2014	1. Bongani stated that he is from Sheepmoor and wanted to	1. Bongani was thanked for his interest in the project. EIMS	The I&AP's details have been recorded and his

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					enquire about a job for his construction company. 2. Bongani thanked EIMS and stated that he awaits a response from the Applicant and requested that his comments be forwarded to the Applicant.	indicated that it is undertaking the environmental assessment on behalf of the mine and as such EIMS is not involved in the employment process. The mine has an employment and procurement policy that they will follow, however EIMS will forward his information to the applicant.	request for employment has been forwarded to the Applicant for possible consideration.
Riaan van Wyk	Surrounding landowner	Register as an I&AP Dust Safety Water quality Accommoda tion	Email	5/05/2014	1. Mr van Wyk indicated that he is a surrounding landowner of the farms Drievrou, Taaibossspruit and Nooitgedag. Mr van Wyk indicated that the Panbult farmers association should be identified as an I&AP. Mr van Wyk also described the receiving environment as one dominated by agriculture, grazing, crop, timber and residential. Mr van Wyk also expressed concerns regarding the impacts that the mine may have on the area with regards to dust and water stating that dust must be minimized by tarring roads and the roads must be made safe. He also indicated water safety	1. EIMS thanked Mr van Wyk for the interest in the Leiden project. EIMS also stated that he has been registered as an I&AP and will be informed of the project as it progresses. EIMS enquired as to whether Mr van Wyk possibly had a contact number for the Panbult Farmers Association with which EIMS could contact them. To date, EIMS has not received contact details from Mr van Wyk for the Panbult Farmers Association. At such a time that these contact details are received, EIMS will undertake to inform the Panbult Farmers Association of the Proposed	Mr van Wyk's concerns (water pollution and air quality) have been identified and will be addressed during the EIA phase through the use of mitigation measures.

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					as a main concern. Mr van Wyk stated that he may be able to offer housing and accommodation for mine personnel.	Leiden Project. Mr van Wyk was also informed that a Draft Integrated Environmental Scoping Report for the proposed Leiden Mine is available on the EIMS website for review. Mr van Wyk was directed to the sections within the report that addressed dust, safety and ground water. He was further informed that during the EIA phase mitigation measures will be designed to mitigate any potential impacts.	
Bradley Gibbons	EWT	I&AP	Email	12/05/2014	1. Mr Gibbons requested that he be registered as an I&AP for the IWULA portion of the Leiden project. 2. Mr Gibbons thanked EIMS for the BID and Registration and questionnaire provided to him. 3. Mr Gibbons thanked EIMS for directing him to the Draft Scoping Report on the website and stated that he would review it once in the office. 4. Mr Gibbons emailed EIMS to	1. Mr Gibbons was thanked by EIMS for his interest in the project and provided with a BID as well as a registration and questionnaire form. 2. EIMS also directed Mr Gibbons to the EIMS website to review the Draft Scoping Report 4. EIMS sent Mr Gibbons the public open day minutes to review.	Mr Gibbons was registered as an I&AP and provided with registration forms to comment on the project.

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
				19/06/2014	inform them that he would not be attending the public open day.		
No name provided	I&AP	Enquiry	Email	23/05/2014	1. The I&AP queried if there was a mine to be built near Panbult.	1. EIMS responded thanking the I&AP for their interest in the project. EIMS attached the BID including a map which provides the locality of the proposed Leiden Project and Registration and questionnaire form for the I&AP to fill in and send back to EIMS.	EIMS sent the relevant documentation and map to the I&AP so that he/she may provide comment to EIMS regarding the Leiden project.
Kenneth	I&AP	Require notification	Telephone call	12/5/2014	1. Kenneth requested further information about the proposed project so that he may provide comment if necessary.	1. Kenneth was emailed a BID and registration and questionnaire form to fill in and return to EIMS.	EIMS sent the relevant forms to the I&AP to provide comment to EIMS regarding the Leiden project.
Hansheinrich Filter	Surrounding Landowner	Water Pollution Air quality Safety Flora and fauna	Email	27/05/2014	1. Mr Filter stated that he is a surrounding landowner and neighbour. He is aware of surrounding rural communities on other farms but was unable to provide contact details. Mr Filter indicated that Piet Rabe and Tommie Ferreira should be notified of the proposed project. Mr Filter indicated that the receiving environment is one of plantations and grazing.	1. Mr Filter was thanked for his interest in the proposed Leiden Project. EIMS stated that Mr Filter is now registered as an I&AP and will be informed of future notifications. Mr Filter was also informed that a Draft Integrated Environmental Scoping Report for the proposed Leiden Mine is available on	Mr Filter's concerns (water pollution, air quality, safety and flora and fauna) have been identified and will be addressed during the EIA phase through the use of mitigation measures. Both Mr Rabe and Mr Ferreira have been included in the I&AP database and have been sent notification documents regarding the

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					Mr Filter stated that he is concerned about the following potential impacts to the area: water pollution, air pollution, safety and flora and fauna.	the EIMS website for review. Mr Filter was directed to the sections within the report that addressed water pollution, air quality, safety and flora and fauna. He was further informed that during the EIA phase mitigation measures will be designed to mitigate any potential impacts.	proposed project. To date no comment has been received from either of these I&AP's.
Sifiso Kubheka	I&AP	Information	Email referral	26/06/2014	1. Mr Kubheka suggested that EIMS contact Beauty Tlou and inform her of the Leiden project.	1. EIMS sent Ms Tlou a copy of the BID which obtains the project information so that she may comment on the project.	EIMS contacted the I&AP and provided her information of the proposed mine as suggested by Mr Kubheka.
F.P Angwenyi	MTPA	Objection	Email/Fax	12/08/2014	1. MTPA objects to the proposed development due to the fact that the property under application falls within the proposed Wakkerstroom Wet Grassland Protected Area. 2. The Mpumalanga C-Plan identified areas of biodiversity importance within the area under application 3. The MTPA identified that the property under application falls within the Ngwempsi Conservancy and suggested	1. EIMS requested that the MTPA provide a map indicating the proposed protected area and provide an update on the status of its promulgation 2. EIMS provided MTPA with a sensitivity map indicating that the proposed mining footprint is located outside of areas of biodiversity importance in the plantation areas. 3. EIMS explained that the only Ngempsi Conservancy that	EIMS responded to the MTPA and requested supplementary information.

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					that the conservancy be contacted for comment 4. MTPA indicated that a critically endangered fish species namely *Barbus anoplus* occurs within the area under application.	can be found is situated in Swaziland. EIMS requested confirmation of the I&AP's contact details in order to include them in the PPP. 4. The aquatic ecology specialist for the project listed the *Barbus anoplus* as Least Concern based on international conservation criteria.	
First Public Open Day (19 June 2014)							
Wilma Le Roux van Niekerk	Landowner	Information	Public Open Day	19/06/2014	1. Mrs van Niekerk read through the posters with the information for the Leiden coal mine project. Mrs van Niekerk inquired if this was all the information? Mrs van Niekerk stated that she does not see any problems and had no objections or further comments on the project.	1. EIMS confirmed that the displayed information was all the information.	Mrs van Niekerk was pleased with the available information provided on the posters at the open day for review by the I&AP's.
Manqoba Kunene And Sbusiso Msibi	Community members from Sheepmoor	Information	Public Open Day	19/06/2014	1. Mr Kunene and Mr Msibi read through the posters with the information for the Leiden coal mine project. Mr Kunene inquired as to what qualifications will be required for the mine.	1. EIMS responded to Mr Kunene by stating that EIMS is the Environmental consultant for the mine and is concerned with the environmental aspects. The tasks that will be required by	Mr Kunene's employment concerns have been addressed by providing him with a preliminary timeline for the environmental aspect of the mining project. EIMS has also assembled all CV's

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					Mr Kunene queried the time of commencement for construction at the mine.	the mine are unknown at this stage, however the details will be included in the Social and Labour Plan (SLP) during the EIA phase. EIMS informed Mr Kunene that the EIA process takes approximately 18-24 months and also depends on the decision making process by the authority. EIMS informed Mr Kunene that a decision is not expected until mid-end 2015. Furthermore if the application is approved, construction may not commence immediately.	received from I&AP's and will forward them to the client for review when employment positions become available in accordance with the SLP.
Mr Sifiso Kubheka	Community member from Sheepmoor	Information	Public Open Day	19/06/2014	1. Mr Kubheka queried the location of the mining area. 2. Mr Kubheka queried the removal of houses within close proximity to the mining area. 3. Mr Kubheka queried the time of commencement for construction at the mine. 4. Mr Kubheka wishes that the application is successful 5. Mr Kubheka queried the	1. EIMS took Mr Kubheka through the prepared poster information. EIMS showed Mr Kubheka on the map where the proposed mining is scheduled to take place. 2. EIMS stated that there are legislative buffer zones that must be adhered to by mining activities to built structures such as homes.	EIMS provided Mr Kubheka with the location of the project to surrounding infrastructure. EIMS has also assembled all CV's received from I&AP's and will be providing them to the client for review when employment positions become available in accordance with the SLP.

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					number of people commenting on the project?	3. EIMS informed Mr Kunene that the EIA process takes approximately 18-24 months and also depends on the decision making process by the authority. EIMS informed Mr Kubheka that a decision is not expected until mid-end 2015. Furthermore if the application is approved, construction may not commence immediately. 5. EIMS stated that few comments have been received to date, mainly CV's from individuals have been received seeking employment should the mine right be approved. EIMS also stated that employment issues will be addressed in the SLP submitted with the EIA documentation. 6. EIMS prepared an electronic copy of the draft scoping report for Mr Kubheka.	
Mr TS Nkosi	Ward 2 Councillor	Information	Public Open Day	19/06/2014	2. Mr Nkosi stated that there has been much interest in employment by community members as a result of seeing	1. EIMS took Mr Nkosi through the prepared poster information. EIMS informed Mr Nkosi that	Mr Nkosi's employment concerns have been addressed by providing him with a preliminary timeline

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					the site notices. 3. Mr Nkosi queried where the location of the mining area is? 4. Mr Nkosi stated that he was happy with the information provided to him at the open day.	the EIA process takes approximately 18-24 months and also depends on the decision making process by the authority. EIMS informed Mr Nkosi that a decision is not expected until mid-end 2015. Furthermore if the application is approved, construction may not commence immediately. 2. EIMS stated that employment issues will be addressed in the SLP submitted with the EIA documentation. 3. EIMS showed Mr Nkosi the locality map indicating where the proposed study area is together with other landmark features for ease of orientation. 4. EIMS provided Mr Nkosi with a soft copy of the draft scoping report and appendices to distribute among those interested within the community.	for the environmental aspect of the mining project. EIMS has also assembled all CV's received from I&AP's and will forward them to the client for review when employment positions become available in accordance with the SLP.
Dr Le Roux van Niekerk	Land owner of the Leiden Farm	Information	Public Open Day	19/06/2014	1. Mr van Niekerk queried whether the mine would be approved? 2. Mr van Niekerk thanked EIMS for the information and stated	1. EIMS stated that from an environmental perspective, the project will proceed to the EIA phase. Further EIMS	EIMS was unable to comment on the granting of the mining right as EIMS is the environmental

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					that he was happy with the project proceeding.	showed Mr van Niekerk the sensitivity map and explained the rankings.	consultant, EIMS did however indicate that an EIA project will be undertaken in due course.
Curriculum Vitae Received from I&AP's							
Gabisile Khumalo	Job Seeker	Employment	Fax	05/2014	1. Ms Khumalo faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible consideration.
Lovedale Khumalo	Job Seeker	Employment	Fax	05/2014	1. Ms Khumalo faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible consideration.
Matildah Habile	Job Seeker	Employment	Fax	05/2014	1. Ms Habile faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible consideration.
John Khoza	Job Seeker	Employment	Fax	23/05/2014	1. Mr Khoza faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the

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							Applicant for possible consideration.
Bongani Habile	Job Seeker	Employment	Fax	05/2014	1. Mr Habile faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Ungafanukwenze Mndebele	Job Seeker	Employment	Fax	05/2014	1. Mr Mndebele faxed a copy of his CV to EIMS	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mbongeni Sibiya	Job Seeker	Employment	Fax	05/2014	1. Mr Sibiya faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Bikela Mshayisa	Job Seeker	Employment	Fax	05/2014	1. Mr Mshayisa faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mzwakhe Mavuso	Job Seeker	Employment	Fax	05/2014	1. Mr Mavuso faxed a copy of his	1. EIMS forwarded the CV to the	The I&AP's details have

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					CV to EIMS.	Applicant.	been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Nhlanhla Mahlobo	Job Seeker	Employment	Fax	16/05/2014	1. Mr Mahlobo faxed a copy of his CV to EIMS	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Kenneth Zwane	Job Seeker	Employment	Fax	22/05/2014	1. Mr Zwane faxed a copy of hi CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Madoda Ndaba	Job Seeker	Employment	Fax	22/05/2014	1. Mr Ndaba faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Zama Gama	Job Seeker	Employment	Fax	21/05/2014	1. Ms Gama faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible

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							consideration.
Precious Mkwanazi	Job Seeker	Employment	Fax	16/05/2014	1. Ms Mkwanazi faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible consideration.
Nonjabulo Zwane	Job Seeker	Employment	Fax	15/05/2014	1. Ms Zwane faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible consideration.
Benson Zwane	Job Seeker	Employment	Fax	15/05/2014	1. Mr Zwane faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Millicent Lukhele	Job Seeker	Employment	Fax	12/05/2014	1. Ms Lukhele faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible consideration.
Ntombentsha Mtshali	Job Seeker	Employment	Fax	02/05/2014	1. Ms Mtshala faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her

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							request for employment has been forwarded to the Applicant for possible consideration.
Vusi Nkosi	Job Seeker	Employment	Fax	02/05/2014	1. Mr Nkosi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Eric Shabangu	Job Seeker	Employment	Fax	02/05/2014	1. Mr Shabangu faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Bongiwe Maseko	Job Seeker	Employment	Fax	02/05/2014	1. Ms Maseko faxed a copy of her CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and her request for employment has been forwarded to the Applicant for possible consideration.
Mfanafuthi Maseko	Job Seeker	Employment	Fax	02/05/2014	1. Mr Maseko faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.

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Dube Ntokozo	Job Seeker	Employment	Fax	27/05/2014	1. Mr Ntokozo faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Shongwe Nkululeko	Job Seeker	Employment	Fax	27/05/2014	1. Mr Nkululeko faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Praise-God Musa Nkosi	Job Seeker	Employment	Fax	9/06/2014	1. Mr Nkosi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Elphas Sonboy Dhadhla	Job Seeker	Employment	Fax	3/06/2014	1. Mr Dhadhla faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant.	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mandlenkosi Excellent Linda	Job Seeker	Employment	Fax	3/06/2014	1. Mr Linda faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the

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							Applicant for possible consideration.
Thela Mlondolozi	Job Seeker	Employment	Fax	31/05/2014	1. Mr Mlondolozi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Zwane Mbongiseni Tony	Job Seeker	Employment	Fax	30/05/2011	1. Mr Tony faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mxolisi Clearence Simelane	Job Seeker	Employment	Fax	5/06/2014	1. Mr Simelane faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Siyabonga Ntshakala	Job Seeker	Employment	Fax	28/05/2014	1. Mr Ntshakala faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Jimson Maseko	Job Seeker	Employment	Fax	29/05/2014	1. Mr Maseko faxed a copy of his	1. EIMS forwarded the CV to the	The I&AP's details have

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					CV to EIMS.	Applicant	been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Sanele Simelane	Job Seeker	Employment	Fax	3/06/2014	1. Mr Simelane faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Titus Thela	Job Seeker	Employment	Fax	3/06/2014	1. Mr Thela faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mphumzeni Mthabela	Job Seeker	Employment	Fax	3/06/2014	1. Mr Mthabela faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Nkosinathi Mbuyisa	Job Seeker	Employment	Fax	3/06/2014	1. Mr Mbuyisa faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
							consideration.
Mayisela Eugene	Job Seeker	Employment	Email	10/06/2014	1. Mr Eugene emailed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Bongane Ndlangamandla	Job Seeker	Employment	Email	10/06/2014	1. Mr Ndlangamandla emailed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Thabang Monareng	Job Seeker	Employment	Email	10/06/2014	1. Mr Monareng emailed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Nkosinathi Maseko	Job Seeker	Employment	Email	10/06/2014	1. Mr Maseko emailed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Richard Zondo	Job Seeker	Employment	Email	10/06/2014	1. Mr Zondo emailed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
							request for employment has been forwarded to the Applicant for possible consideration.
Mike Magagua	Job Seeker	Employment	Fax	10/06/2014	1. Mr Magagua faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Makhosonke Mbatha	Job Seeker	Employment	Fax	10/06/2014	1. Mr Mbatha faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mthokozisi Phakathi	Job Seeker	Employment	Fax	10/06/2014	1. Mr Phakathi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Sydney Skhonana	Job Seeker	Employment	Fax	10/06/2014	1. Mr Skhonana faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.

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Velaphi Motha	Job Seeker	Employment	Fax	10/06/2014	1. Mr Motha faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Michael Mkhonto	Job Seeker	Employment	Fax	9/06/2014	1. Mr Mkhonto faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Babali Mkhwanazi	Job Seeker	Employment	Fax	9/06/2014	1. Mr Mkhwanazi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Winile Ntshangase	Job Seeker	Employment	Fax	11/06/2014	1. Mr Ntshangase faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Sebenzile Ntshangase	Job Seeker	Employment	Fax	11/06/2014	1. Mr Ntshangase faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
							Applicant for possible consideration.
Hlengiew Ntshangase	Job Seeker	Employment	Fax	11/06/2014	1. Mr Ntshangase faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
David Simelane	Job Seeker	Employment	Fax	11/06/2014	1. Mr Simelane faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Msawenkosi Maseko	Job Seeker	Employment	Fax	11/06/2014	1. Mr Maseko faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mshayisa William	Job Seeker	Employment	Fax	11/06/2014	1. Mr William faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mphikeleli Manana	Job Seeker	Employment	Fax	12/06/2014	1. Mr Manana faxed a copy of his	1. EIMS forwarded the CV to the	The I&AP's details have

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					CV to EIMS.	Applicant	been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Dumisani Nkosi	Job Seeker	Employment	Fax	12/06/2014	1. Mr Nkosi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Zanele Skhosana	Job Seeker	Employment	Fax	12/06/2014	1. Mr Skhosana faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Elijah Habile	Job Seeker	Employment	Fax	12/06/2014	1. Mr Habile faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Skhosana Mduduzi	Job Seeker	Employment	Fax	12/06/2014	1. Mr Mduduzi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
							consideration.
Vilikazi Solomon	Job Seeker	Employment	Fax	12/06/2014	1. Mr Solomon faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mandla Mdhluli	Job Seeker	Employment	Fax	12/06/2014	1. Mr Mdhluli faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Thokozane Mkhonto	Job Seeker	Employment	Fax	12/06/2014	1. Mr Mkhonto faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Jerome Nkosi	Job Seeker	Employment	Fax	13/06/2014	1. Mr Nkosi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Philiph Mathebula	Job Seeker	Employment	Fax	17/06/2014	1. Mr Nkosi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
							request for employment has been forwarded to the Applicant for possible consideration.
Nkosi Patrick	Job Seeker	Employment	Fax	20/06/2014	1. Mr Patrick faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Mandla Nxumalo	Job Seeker	Employment	Fax	20/06/2014	1. Mr Nxumalo faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Bongane Zane	Job Seeker	Employment	Fax	17/06/2014	1. Mr Zane faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Muzi Mayisela	Job Seeker	Employment	Fax	18/06/2014	1. Mr Mayisela faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
Jabulani Shabangu	Job Seeker	Employment	Fax	14/06/2014	1. Mr Shabangu faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Goodness Hlophe	Job Seeker	Employment	Fax	18/06/2014	1. Mr Hlophe faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Bongani Xaba	Job Seeker	Employment	Fax	18/06/2014	1. Mr Xaba faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Thabo Motaung	Job Seeker	Employment	Fax	18/06/2014	1. Mr Motaung faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Sifiso Shongwe	Job Seeker	Employment	Fax	23/06/2014	1. Mr Shongwe faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
							Applicant for possible consideration.
Siphamandla Shongwe	Job Seeker	Employment	Fax	20/06/2014	1. Mr Shongwe faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Thulani Simelane	Job Seeker	Employment	Fax	23/06/2014	1. Mr Simelane faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Nhlanhla Mashinini	Job Seeker	Employment	Fax	23/06/2014	1. Mr Mashinini faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Vusumuzi Gama	Job Seeker	Employment	Fax	23/06/2014	1. Mr Gama faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Jabhi Motaung	Job Seeker	Employment	Fax	24/06/2014	1. Mr Motaung faxed a copy of his	1. EIMS forwarded the CV to the	The I&AP's details have

Name	Organisation	Aspect	Method	Date	Comment	Response	How issue is addressed
					CV to EIMS.	Applicant	been recorded and his request for employment has been forwarded to the Applicant for possible consideration.
Sizwe Nkosi	Job Seeker	Employment	Fax	06/2014	1. Mr Nkosi faxed a copy of his CV to EIMS.	1. EIMS forwarded the CV to the Applicant	The I&AP's details have been recorded and his request for employment has been forwarded to the Applicant for possible consideration.

9.6.3 SIGNIFICANT COMMENTS, CONCERNS, AND OBJECTIONS RAISED

The majority of comment received during the scoping phase related to employment opportunities. One objection has been received from the Mpumalanga Tourism and Parks Agency (MTPA) with reference to the environmental sensitivities of the proposed project location. As comment from I&AP's is received, the Issues and Responses Register will be updated.

10 ADEQUACY OF PREDICTIVE METHODS, UNDERLYING ASSUMPTIONS AND UNCERTAINTIES

The assumptions, uncertainties and limitations for the specialist studies have been drawn from the relevant reports as provided by the specialists.

10.1 ENVIRONMENTAL ASSESSMENT LIMITS

The specialist reports did not assess the health and safety of workers as this is assumed to be regulated separately by the Occupational Health and Safety legislation.

10.2 PREDICTIVE MODELS

Predictive models are only as accurate as the data provided, therefore, if the input data becomes inaccurate or inapplicable due to project design changes or alterations to other variables, the predictive models will decrease in accuracy.

10.3 HERITAGE AND CULTURAL RESOURCES

The following assumptions and limitations can be identified:

- The exact way in which the proposed mining (i.e. opencast or high wall mining) will be undertaken is presently unknown. However, for the purposes of this report it was assumed that opencast mining would take place.
- The potential presence of stillborn babies in proximity to the development area was primarily based on the indication of a black homestead on an old topographic map in proximity to the development area as well as the previous experience of the staff at PGS Heritage which suggests the potential for stillborn babies to be associated with older black homesteads. This potential presence of stillborn babies within the development area is however remote but needed to be raised in this report.
- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage sites identified during the desktop study and fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage features or objects not included in the inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way, until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.

10.4 SOCIO-ECONOMIC ENVIRONMENT

The following social assumptions and limitations were relevant:

- Not every individual in the community could be interviewed therefore only key people in the community were approached for discussion. Key people were identified based on their positions in the community, interest and availability to contribute to the study. Additional information was obtained using existing data, records of public meetings and via telephonic and personal interviews.
- The social environment constantly changes and adapts to change, and external factors outside the scope of the project can offset social changes, for example changes in local political leadership. It is therefore difficult to predict all impacts to a high level of accuracy, although care has been taken to identify and address the most likely impacts in the most appropriate way for the current local context within the limitations.
- Social impacts can be felt on an actual or perceptual level, and therefore it is not always straightforward to measure the impacts in a quantitative manner.
- Social impacts commence when the project enters the public domain. Some of these impacts are thus already taking place, irrespective of whether the project continues or not. These impacts are difficult to mitigate and some would require immediate action to minimise the risk.
- There are different groups with different interests in the community, and what one group may experience as a positive social impact, another group may experience as a negative impact. This duality will be pointed out in the impact assessment phase of the report.

The following economic assumptions and limitations were relevant:

- The first and probably most important assumption is that the proposed mining activities will be economically viable. Without economic viability (that is an acceptable risk-return rate is attained on investment), the probability of achieving the stated economic benefits are non-existent. This assessment accepts the rational investor concept, thus the investments to be committed are undertaken by a rational economic agent and the probability of achieving economic viability is high.
- This study is mainly based on secondary economic data. The macro-economic data for this analysis was supplied by Quantec, a reliable regional economic data provider in SA.
- It is assumed that the land deemed to be potentially lost to agriculture and forestry is utilised at the average productivity of the country's output for those sectors. The need to work on macro-averages is due to the fact that statistics supplied by individuals are regarded as private and is rarely shared in the public domain.
- The receptor area is the immediate local area.
- The project is evaluated over the period of an economic generation, even though the life of mine is less than this. The valuations are done on a Discounted Cash Flow

basis, thus discounting all benefits over an economic generation. In essence this reduces the economic value of the project relative to existing land-use.

- It is assumed that the land impacted by mining will be sterile and of no real use economically after mining. (Note, this is not always the case, but is done to be conservative and in the light of the many environmental legacy issues caused by mining.)
- In this analysis it is assumed that mining and agricultural is a zero-sum outcome, thus the benefit to the one is a loss to the other. (In reality the spirit of sustainable development is for economic agents to co-operate constructively in order for society to achieve a win-win, however, such an outcome is uncertain and naïve to assume.)
- The economic analysis section of this study will adopt a dispassionate compassionate stance, thus it concerns itself with the benefits or costs to the economy in a macro-economic and quantitative manner. The mathematical results, based on stated assumptions, therefore speak for themselves.
- This analysis should not be used for compensation negotiations between the mine and affected stakeholders simply because its intent is to compare a better alternative land use, using economic macro-variables and not micro-magnitudes.

10.5 GEOCHEMISTRY

The various geochemical parameters were assessed on a generalized qualitative base. The geology, which forms the basis of the geochemical assessment, was sourced from published literature. No physical borehole core logging was performed and no detailed mine plan was available. In terms of the effect of mining on the environment, a worst case scenario was considered which involved an open cast and underground mining method and maximum interaction between the mine and both the surface and underground aquatic environment.

10.6 SOILS, LAND USE, AND LAND CAPABILITY

There is a good level of certainty concerning the soils occurring within the study area, subsequently confirmed by the site visit. The soils show a high degree of uniformity.

10.7 FLORA

The vegetation units were delineated based on the aerial photographs and verified in the field. This gives a very good indication of the general vegetation condition. The assessment was however conducted during only two site visits and it is therefore likely that some species in the primary vegetation communities have been missed. The vegetation survey in the proposed open cast mining area and proposed structure is however mostly located in disturbed areas and the survey in these areas is therefore considered to be fairly complete. Although habitat is present in the wetland area for *Eucomis autumnalis*, the habitat is marginal and the species is not expected to be present. It is however possible that the species may be present and has not been observed during the survey.

10.8 FAUNA

The following assumptions and limitations were relevant:

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of ommitting any species, but it is always possible that a species that does not occur on a list may be located in an area where it was not previously known to exist.
- Animal species are mostly highly mobile and often migrate seasonally. Any field assessment of relatively short duration is therefore unlikely to record anything more than the most common species that happen to be on site at the time of the survey. This is a poor reflection of the overall diversity of species that could potentially occur on site.

10.9 SURFACE WATER

- The surface water study was conducted based on a site visit and information provided by the client at the time of writing.
- The mine plan was obtained from the client and the SWMP and Water Balance were based on this information. Should the mine plan change in any way, the surface water impact assessment will require revision.
- Since the mine is not operational, a number of assumptions were made in the construction of the Water Balance (detailed below):
    - The following assumptions were made to develop the Process Flow Diagram (PFD) and Water Balance model:
    - The Water Balance was calculated for a full mining operation with a maximum production of 410 462 tonnes per year;
    - Climate and hydrological data used for the Water balance was taken from Section 6.2
    - The total dirty water surface area was taken from Section 9 which was 19ha
    - The Discard dump/Carbonaceous stockpile surface area were measured at 2.22ha;
    - The coal stockpile surface area was measured at 0.29ha;
    - Runoff from the Discard Dump/Carbonaceous Stockpile was assumed to be directed into the storm water dam;
    - The PCD surface areas were provided in the infrastructure layout (2 PCDs) and measured at a maximum 0.347ha together;

- The surface area of the storm water dam was assumed at a maximum of 0.231ha. Runoff from the entire site area was assumed to be captured in the storm water dam;
- A continuous treatment rate of $2.5m^3$/hour of the water purification plant was provided by the Client;
- Mine water requirements were provided by the Client and comprised 100 litres per ton mined;
- The maximum expected groundwater ingress of $742m^3$/day was taken from the groundwater specialist study (GCS, 2014). This water was transferred to the PCDs for re-use;
- Product moisture content losses were assumed at 5% moisture content of the coal product;
- Potable water user numbers were confirmed by the Client and assumed at a maximum occupancy of 120 people on site consuming 50 litres per day;
- The waste water treatment plant (WWTP) receives water from the potable water users and transfers treated water to the PCDs for re-use.
- The wash bay water consumption was assumed at $5m^3$/day;
- Dust suppression on roads was assumed at 5mm per day for 2.5km of roads within the site area. Additional dust suppression was assumed for 3.5km on access roads in the vicinity of the site area, and
- Excess water volumes in the Water Balance are shown in the water in the PCDs.

- The process flow diagram was constructed with input from the Client.
- The flood lines and SWMP were based on 20m contours and therefore the accuracy is not detailed. 1m contours are recommended for future flood line updates.

10.10 WETLANDS

Wetland boundaries reflect the ecological boundary where the interaction between water and plants influences the soils, but more importantly the plant communities. The depth to the water table where this begins to influence plant communities is approximately 50 centimetres. This boundary, based on plant species composition, can vary depending on antecedent rainfall conditions, and can introduce a degree of variability in the wetland boundary between years and/or sampling period.

This report presents the findings of two site visits, undertaken on the 2nd April 2013 and again on the 12th July 2014.

Reference conditions for the wetlands on site are unknown. This limits the confidence in the PES assessment.

Due to the scale of the remote imagery used (1:10 000 orthophotos and Google Earth Imagery), as well as the accuracy of the handheld GPS unit used to delineate wetlands in the field, the delineated wetland boundaries cannot be guaranteed beyond an accuracy of about 20m on the ground. Should greater mapping accuracy be required, the wetlands would need to be pegged in the field and surveyed using conventional survey techniques.

10.10.1.1 Adequacy of predictive measures

A number of generally accepted assessment methods were utilised within the current study for the assessment of the wetland and aquatic habitats on site:

- WET-Eco-Services (Kotze *et al*., 2009)
- WET-Health (Macfarlane *et al*., 2009)

Although there are limitations associated with each of these methods, the methods are generally accepted and widely applied within environmental impact assessments in South Africa and are deemed adequate for the purpose of this study.

10.11 AQUATIC ECOLOGY

- Reference conditions are unknown. This limits the confidence with which the present ecological category is assigned;
- Aquatic ecosystems vary both temporally and spatially. Once-off surveys such as this are therefore likely to miss substantial ecological information, thus limiting accuracy, detail and confidence.
- The findings within this report are based on a once-off field visit. Aquatic biota vary spatially and temporally and, as such, species may have been missed.
- While considerable desktop information was researched for the affected study area, reference conditions cannot ever be fully known with a high degree of certainty.
- Identified gaps in knowledge include: a lack of seasonal data and a lack of ground truthed ecological information – in particular, further fish surveys would increase the level of confidence with which results are discussed.
- The discussion of conditions within the Ngwempisi River was based on the inter basin transfer being operational. It is not known whether water is pumped throughout the year or just during dry months and, if the latter, what the ecological conditions within the Ngwempisi River without the inter basin transfer would be.
- Mitigation measures and recommended management actions focus on the management of aquatic ecosystems and are not conclusive.

10.12 VISUAL

The following assumptions were made for the propose of this report:

- For both Alternatives 2 and 3 the open cast mining section would be completed before the underground mining infrastructure would be constructed.
- Because the open cast mining would be done in a roll-over method where continuous rehabilitation would occur and the fact that compared to the life of mine (10 years) vs

the short period of the extended opencast section, the negative visual impact that would result from the scarring of the land by the open cast activities before rehabilitation kicks in, would be negligible.

- All mitigation measures are implemented effectively and successfully.
- All mining structures will be removed during decommissioning phase.
- The land will be rehabilitated back to either plantation or grazing status after rehabilitation and closure.
- Public response, used in determining the prioritisation factor, was determined from the comments by the public during informal discussions at the time of the site visit and not from an official survey.

10.13 NOISE

10.13.1 MEASUREMENTS OF AMBIENT SOUND LEVELS

Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. High measurements may not necessarily mean that noise levels in the area are high. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of the day, faunal characteristics, vegetation in the area and meteorological conditions (especially wind). This is excluding the potential effect of sounds from anthropogenic origin. It is impossible to quantify and identify the numerous sources that influenced one 10-minute measurement using the reading result at the end of the measurement. Therefore trying to define ambient sound levels using the result of one 10-minute measurement will be very inaccurate (very low confidence level in the results) for the reasons mentioned above. The more measurements that can be collected at a location the higher the confidence levels in the ambient sound level determined. The more complex the sound environment, the longer the required measurement (especially when at a community or house. This study did collect measurements at one location for approximately 22 hours in 10-minute bins. It is assumed that the measurement location represents other residential dwellings in the area (similar environment), yet, in practice this can be highly erroneous as there are numerous factors that can impact on ambient sound levels, including:

- The distance to closest trees, number and type of trees as well as the height of trees;
- Available habitat and food for birds and other animals;
- Distance to residential dwelling, type of equipment used at dwelling (compressors, air-cons);
- General maintenance condition of house (especially during windy conditions);
- Number and type of animals kept in the vicinity of the measurement locations.

Determination of existing road traffic and other noise sources of significance are important (traffic counts etc.). Traffic however is highly dependent on the time of day as well as general agricultural activities taking place at the time of traffic counts. Traffic noise is one of the major components in urban areas and could be a significant source of noise during busy periods. This study found that traffic in the area was very low, yet it cannot be assumed that is is always low.

Measurements over wind speeds of 3 m/s could provide data influenced by wind-induced noises. While the windshields used limits the effect of fluctuating pressure across the microphone diaphragm, the effect of wind-induced noises in the trees in the vicinity of the microphone did impact on the ambient sound levels. The site visit unfortunately coincided with a relatively windy period;

Ambient sound levels are depended not only time of day and meteorological conditions, but also change due to seasonal differences. Ambient sound levels are generally higher in summer months when faunal activity is higher and lower during the winter due to reduced faunal activity. Winter months unfortunately also coincide with lower temperatures and very stable atmospheric conditions, ideal conditions for propagation of noise;

Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high. This is due to faunal activity which can dominate the sound levels around the measurement location; and

As a residential area develops the presence of people will result in increased sounds. These are generally a combination of traffic noise, voices, animals and equipment (incl. TV’s and Radios). The result is that ambient sound levels will increase as an area matures.

10.13.2 CALCULATING NOISE EMISSIONS – ADEQUACY OF PREDICTIVE METHODS

The noise emissions into the environment from the various sources as defined will be calculated for the operational phase in detail, using the sound propagation model described in ISO 9613-2.

The following was considered:

- The octave band sound pressure emission levels of processes and equipment;
- The distance of the receiver from the noise sources;
- The impact of atmospheric absorption;
- The operational details of the proposed project, such as projected areas where activities will be taking place;
- Topographical layout,
- Acoustical characteristics of the ground. 50% soft ground conditions were modelled, as the area where the mining activity would be taking place is well vegetated and sufficiently uneven to allow the consideration of relatively soft ground conditions. This is because the use of hard ground conditions could represent a too precautionary situation.

The noise emission into the environment due to additional traffic will be calculated using the sound propagation model described in SANS 10210. Corrections such as the following will be considered:

- Distance of receptor from the road;
- Road construction material;
- Average speeds of travel;
- Types of vehicles used;
- Ground acoustical conditions

It is important to understand the difference between sound or noise level as well as the noise rating level (also see Glossary of Terms).

Sound or noise levels generally refers to a sound pressure level as measured using an instrument, whereas the noise rating level refers to a calculated sound exposure level to which various corrections and adjustments was added. These noise rating levels are further processed into a 3D map illustrating noise contours of constant rating levels or noise isopleths. In this project it illustrate the potential extent of the calculated noises of the complete project and not noise levels at a specific moment in time. It is used to define potential issues of concern and not to predict a noise level at a potential noise-sensitive receptor. For this the selected model is internationally recognised and considered adequate.

10.13.3 ADEQUACY OF UNDERLYING ASSUMPTIONS

Noise experienced at a certain location is the cumulative result of innumerable sounds emitted and generated both far and close, each in a different time domain, each having a different spectral character at a different sound level. Each of these sounds are also impacted differently by surrounding vegetation, structures and meteorological conditions that result in a total cumulative noise level represented by a few numbers on a sound level meter.

As previously mentioned, it is not the purpose of noise modelling to accurately determine a likely noise level at a certain receptor, but to calculate a noise rating level that is used to identify potential issues of concern. The area is also relatively rural will little significant industrial sounds. For this the assumptions are more than adequate.

10.13.4 UNCERTAINTIES OF INFORMATION PROVIDED

While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise levels at a receptor from any operation. The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. Assumptions include:

- The octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of this processes/equipment. The determination of these levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;

- Sound power emission levels from processes and equipment change depending on the load the process and equipment is subject too. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load. Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worse-case scenario;
- As it is unknown which processes and equipment will be operational (and when operational and for how long), modelling considers a scenario where all processes and equipment are under full load for a set time period. Modelling assumptions complies with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would likely over-estimate noise levels;
- Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor.
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify;
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. 50% soft ground conditions will be modelled as the area where the operation is taking place is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

10.14 BLASTING AND VIBRATION

Considering the stage of the project, the data observed was sufficient to conduct an initial study. Surface surroundings change continuously and this should be taken into account prior to any final design and review of this report. This report is based on data provided and international accepted methods and methodology used for calculations and predictions.

11 DESCRIPTION AND ARRANGEMENT FOR MONITORING AND MANAGEMENT OF ENVIRONMENTAL IMPACTS

This section describes the arrangements for monitoring and management of the environmental impacts identified in Section 7. Furthermore, this section serves to outline the functional requirements, roles and responsibilities and monitoring timeframes. Additional considerations for planned monitoring, as identified by specialists, are included in Section 22.

11.1 LIST OF IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts to the receiving environment that require on-going environmental monitoring include the following:

- Air quality ;
- Blasting and vibration;
- Biodiversity;
- Groundwater;
- Surface water;
- Noise;
- Rehabilitation; and
- Wetlands and aquatic ecology

As mines and the environment are both dynamic it is likely that future scenarios may require the monitoring of additional or unforeseen impacts. As such, the list provided is by no means conclusive and must instead be used as a guideline for the impacts that require monitoring.

11.2 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES

The purpose of monitoring is not merely to collect data, but to provide information necessary to make informed decisions on managing and mitigating potential impacts. Monitoring therefore serves the following functions;

- Serve as early warning system to detect any potential negative impacts;
- To provide information to feedback into management controls to avoid, prevent or minimise potential negative impacts;
- Provide quantitative data that can serve as evidence for the presence of negative impacts or the lack thereof; and

- Allows for trending, modelling and prediction of future conditions or potential impacts

Based on the above, the applicant must ensure that monitoring programmes comprise of the following (at a minimum) in order to obtain valuable environmental data:

- Environmental aspect monitoring must be a formalised procedure;
- All equipment used in monitoring must be correctly calibrated and serviced regularly;
- Samples required for analysis will be sent to an independent and accredited laboratory;
- Monitoring data must be stored;
- Data must be checked and interpreted and tending undertaken on a quarterly basis;
- Both the date and reports on environmental monitoring must be kept on record for the life of mine and where relevant provided to I&AP's; and
- The general and site specific parameters to be monitored must be identified by an independent specialist, the authorities and where relevant I&AP's.

As a result of the studies undertaken, each contributing project specialist has (where relevant) provided considerations and further guidelines for the establishment of monitoring programmes

11.3 MONITORING ROLES AND RESPONSIBILITIES

The role and responsibility of implementing and executing environmental monitoring is allocated to the Mine Environmental Manager. The Mine Environmental Manager must ensure the following:

- Identify and appoint appropriately qualified individuals to develop, design and establish monitoring programmes;
- Ensure that monitoring programmes are scoped correctly and implemented prior to construction (unless advised differently by a specialist) ;
- Make provision for any changes or new monitoring requirements in both existing and new environmental monitoring programmes; and
- Ensure that adequate budget is set aside for environmental monitoring.

It is important to note that in addition to the roles and responsibilities of the Environmental Manager, the details of environmental monitoring must routine be communicated to the mine manager and operations staff.

11.4 TIMEFRAMES FOR MONITORING AND REPORTING

The timeframe for monitoring and reporting on the result of environmental monitoring are provided below.

Table 33: Monitoring timeframes

Impact	Timeframe & Frequency	Reporting Frequency
Air quality	All project phases As per specialist advice	Monthly
Blasting and vibration	Each blast As required by sensitive I&AP's	Monthly
Biodiversity	All project phases As per specialist advice	Monthly
Groundwater	All project phases As per specialist advice	Monthly
Surface water	All project phases As per specialist advice	Monthly
Noise	All project phases As per specialist advice As required by sensitive I&AP's	As required
Rehabilitation	Operational phase Decommissioning phase Closure and rehabilitation phase	Monthly
Wetlands and ecology	All project phases	Monthly

12 TECHNICAL SUPPORTING INFORMATION

The following specialist studies were undertaken as part of the EIA and have been considered/incorporated in the compilation of this EMPR:

Appendix A – Impact Assessment Tables

Appendix B – Full Size Figures

Appendix C – Heritage and Palaeontology Specialist Report

Appendix D – Social Specialist Report

Appendix E – Economic Specialist Report

Appendix F – Geochemistry Specialist Report

Appendix G – Soils, Land Use and Land Capability

Appendix H – Flora Specialist Report

Appendix I – Fauna Specialist Report

Appendix J - Surface Water Specialist Report

Appendix K – Wetland Specialist Report

Appendix L– Aquatic Ecology Specialist Report

Appendix M – Geohydrology Specialist Report

Appendix N – Air Quality Specialist Report

Appendix O – Visual Specialist Report

Appendix P – Noise Specialist Report

Appendix Q – Blasting and Vibration Specialist Report

Appendix R – Traffic Specialist Report

Appendix S – Public Participation

SECTION 2: ENVIRONMENTAL MANAGEMENT PROGRAMME

13 ENVIRONMENTAL MANAGEMENT PRINCIPLES

NEMA establishes a general framework for environmental law, in part by prescribing national environmental management principles that must be applied when making decisions that may have a significant impact on the environment. These principles are briefly summarised below:

13.1 HOLISTIC PRINCIPLE

The Holistic principle, as defined by NEMA (Section 2(4)(b) requires that environmental management must be integrated, acknowledging that all elements of the environment are linked and inter-related and it must take into account the effect of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option (defined below). Holistic evaluation does not mean that a project must be looked at as a whole. It rather means that it must be accepted that there is a whole into which a project introduced. If the indications are that the project could have major adverse effects, the project must be reconsidered and where appropriate re-planned or relocated to avoid an adverse impact or to ensure a beneficial impact.

13.2 BEST PRACTICABLE ENVIRONMENTAL OPTION

When it is necessary to undertake any action with environmental impacts, the different options that could be considered for the purpose must be identified and defined. The Best Practicable Environmental Option (BPEO) is defined in NEMA as “the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.” Other guidelines typically used for environmental management in terms of other legislation include: BPM which is the Best Practicable Means and BAT which is the Best Available Technology.

13.3 SUSTAINABLE DEVELOPMENT

The concept of sustainable development was introduced in the 1980’s with the aim to ensure that the use of natural resources is such that our present needs are provided without compromising the ability of future generations to meet their own needs. The constitution of South Africa is built around the fact that everyone has the right to have the environment protected through reasonable legislative and other measures that secure ecologically sustainable development. The National Environmental Principles included in the NEMA require development to be socially, environmentally and economically sustainable

13.4 PREVENTATIVE PRINCIPLES

The preventative principle is fundamental to sustainable development and requires that the disturbance to ecosystems and the pollution, degradation of the environment and negative impacts on the environment be avoided, or, where they cannot be altogether avoided, are minimised and remedied

13.5 THE PRECAUTIONARY PRINCIPLE

The precautionary principle requires that where there is uncertainty, based on available information, that an impact will be harmful to the environment, it is assumed, as a matter of precaution, that said impact will be harmful to the environment until such time that it can be proven otherwise. The precautionary principle requires that decisions by the private sector, governments, institutions and individuals need to allow for and recognise conditions of uncertainty, particularly with respect to the possible environmental consequences of those decisions. In South Africa, the DWA (then DWAF) adopted a BPEO guideline in 1991 for water quality management and in 1994 in the Minimum Requirements document for waste management.

In terms of DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, the precautionary principle is defined as, “Where a risk is unknown; the assumption of the worst case situation and the making of provision for such a situation.” Here the precautionary principle assumes that a waste or an identified contaminant of a waste is “both highly hazardous and toxic until proven otherwise.”

In the context of the EIA process in South Africa, the precautionary principle also translates to a requirement to provide sound, scientifically based, information that is sufficient to provide the decision making authority with reasonable grounds to understand the potential impacts on the environment, the extent thereof and how impacts could be mitigated. If such information is not adequate for this purpose, the relevant authority cannot be satisfied as is required and then the authority should require that further information be collected and provided.

13.6 DUTY OF CARE AND CRADLE TO GRAVE PRINCIPLE

In terms of the NEMA Section 28, “Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.”

By way of example, the principle of “duty of care” in terms of waste management emphasises the responsibility to make sure that waste is correctly stored and correctly transported, as it passes through the chain of custody to final point of disposal. This means that waste must always be stored safely and securely. The company removing and disposing of waste also holds the responsibility to hold the relevant licenses, and that waste is transported alongside the necessary paperwork.

“Cradle to Grave” refers to the responsibility a company takes for the entire life cycle of a product, service or program, from design to disposal or termination. In terms of the DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, “any person who generates, transports, treats or disposes of waste must ensure that there is no unauthorised transfer or escape of waste from his control. Such a person must retain documentation describing both the waste and any related transactions. In this way, he retains responsibility for the waste generated or handled.” This places responsibility for a waste on the Generator, and is supported by the "Cradle to Grave" principle, according to which a "manifest" accompanies each load of Hazardous Waste until it is responsibly and legally disposed. This manifest is transferred from one transporter to the next along with the load, should more than one transporter be involved. Once the waste is properly disposed of at a suitable, permitted facility, a copy of the manifest must be returned to the point of origin.” Duty of Care offers one strategy to implement sustainable development.

13.7 POLLUTER PAYS PRINCIPLE

The "polluter pays principle" holds that the person or organisation causing pollution is liable for any costs involved in cleaning it up or rehabilitating its effects. It is noted that the polluter will not always necessarily be the generator, as it is possible for responsibility for the safe handling, treatment or disposal of waste to pass from one competent contracting party to another. The polluter may therefore not be the generator, but could be a disposal site operator or a transporter. Through the 'duty of care' principle, however, the generator will always be one of the parties held accountable for the pollution caused by the waste. Accordingly, the generator must be able to prove that the transferral of management of the waste was a responsible action. The polluter pays principle acceding to NEMA dictates that “the cost of remedying pollution, environmental degradation and consequent adverse effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.”

14 DUTY OF CARE RESPONSIBILITIES

Training and awareness should be fostered in all staff working to ensure that they can perform their duties. Failure to comply with the provisions in the EMPR and NEMA would be a contravention of the Act. The relevant sections of NEMA are provided below, to outline the duty of care and responsibility that the applicant and all employees have to towards the environment. The National Environmental Management Act (Act 107 of 1998) (NEMA) Section 28: makes provision for Duty of care and remediation of environmental damage. The binding principals are described below:

1. Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.
2. Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-
   a) any activity or process is or was performed or undertaken; or
   b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.
3. The measures required in terms of subsection (1) may include measures to-
   a) investigate, assess and evaluate the impact on the environment;
   b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
   c) cease, modify or control any act, activity or process causing the pollution or degradation;
   d) contain or prevent the movement of pollutants or the cause of degradation;
   e) eliminate any source of the pollution or degradation; or
   f) remedy the effects of the pollution or degradation.
4. No person may-
   a) unlawfully and intentionally or negligently commit any act or omission which causes significant or is likely to cause significant pollution or degradation of the environment;

b) unlawfully and intentionally or negligently commit any act or omission which detrimentally affects or is likely to affect the environment in such manner; or

c) refuse to comply with a directive issued under this section.

Any person who contravenes or fails to comply with subsection (14) is guilty of an offence and liable on conviction to a fine not exceeding R1million or to imprisonment for a period not exceeding 1 year or to both such a fine and such imprisonment.

15 FAILURE TO COMPLY WITH ENVIRONMENTAL CONSIDERATIONS

Within the provisions of the relevant environmental legislation, there are a number of penalties for non-compliance or offences. Below a few extracts are presented for information purposes, however these must not be read in isolation and the reader is reminded that there are other acts that may be applicable to the relevant project:

- NEMA Section 24F(2): It is an offence for any person to fail to comply with or to contravene the conditions applicable to any environmental authorization granted for that listed activity. 24F(4) A person convicted for an offence under subsection 2 is liable to a fine not exceeding 5 million rand or to imprisonment not exceeding 10 years or to both such a fine and imprisonment;
- NEMA Section 34(6): Whenever any manager, agent or employee does or omits to do an act which it had been his or her task to do, or to refrain from doing on behalf of the employer and which would be an offence under any provision listed in Schedule 3 (relates to all environmental related acts) for the employer to do or omit to do, he or she shall be liable to be convicted and sentenced in respect thereof as if he or she were the employer;
- NWA Section 151 (1): "No person may fail to comply with any condition attached to a permitted water use (Water Use License)";
- NWA Section 151 (2): "Any person who contravenes any provision of subsection 1 is guilty of an offence and liable, on the first conviction, to a fine or imprisonment for a period not exceeding 5 years or to both a fine and such imprisonment (10 years for second conviction)";
- In addition, if anyone is convicted of an offence under the act which has resulted in harm, loss or damage to any other person, the court may award damages to be paid by the accused or convicted;
- NWA Section 154: Makes provision that it's not only the applicant that may be liable but also an employee or agent acting on their behalf;
- In terms of the MPRDA, Section 98, any person is guilty of an offence if he or she fails to comply with the requirements of the issued mining permit; and
- MPRDA Section 99 (1a): any person convicted of an offence in terms of the MPRDA is liable to a fine not exceeding R100, 000 or to imprisonment to a period not exceeding 2 years or to both such fine and imprisonment.

It is recommended that a procedure for non-compliances (i.e. incentives or disincentives for conformance and non-conformance with the EMP requirements) must be employed to ensure that the EMP is adequately implemented. The system to be used must be determined before mining commences, included in the tender documents and contracts, and made clear to all project workers. The system may include that the independent ECO can be authorized to impose spot fines on the Contractor and/or his subcontractors for any of the transgressions detailed below:

- Littering on site;
- Lighting of illegal fires on site;
- Persistent or un-repaired oil leaks;
- Any persons, vehicles or equipment related to the Contractor’s operations found within the designated “no – go” areas;
- Any vehicles being driven in excess of designated speed limits;
- Removal and/or damage to fauna, flora or heritage objects on site; and
- Legal contraventions.

Such fines should be issued in addition to any remedial costs incurred as a result of non-compliance with the Environmental Specifications and or legal obligations.

16 ROLES AND RESPONSIBILITIES

The applicant will be responsible for ensuring overall compliance with the provisions of the EMPR. Implementation is the key to the success of the EMPR and arguably one of the most difficult components to achieve. In order to ensure that the EMPR and its mitigation measures are implemented, roles and responsibilities need to be clearly defined, documented and communicated to the key role players prior to commencement. This section serves as a guide on which party is normally responsible for certain tasks. Specific roles are designated in the detailed environmental management and mitigation requirements in this EMPR. The table below serves as a guide on which party is normally responsible for certain tasks.

16.1 THE PROJECT PROPONENT

The applicant is the principal party of the mine operation. The legal accountability for correct implementation of the relevant requirements of the EA and EMPR falls upon the applicant. Where mining activities are contracted out (e.g. to Contractors and Subcontractors), the liability associated with non-compliance still rests with the Applicant (unless otherwise agreed upon between the authorities, the Applicant and the contracting parties). It is therefore important that these requirements are enforced on any contractor, agent or service provider acting on behalf of the applicant in relation to this project. It is therefore important that the relevant licenses, authorizations, permits, EMPR and any other relevant environmental norms and standards are included in the contractual conditions of any such parties acting on the Applicants behalf.

The Applicant (and not the Contractor) is responsible for liaising directly with the relevant authorities with respect to the preparation and implementation of the EMPR. All project activities must adhere to and comply with all South African legislation and regulations and this requirement must also be included in the Contractors'/Applicant conditions. Should there be changes in legislation and/or regulations then action will be taken to incorporate such changes and to pass these requirements on to the Contractors.

The applicant's role includes:

- Provide all necessary supervision during the execution of the project. Representation from the Applicant should be available on site all the time;
- Provide the necessary support in terms of resources (people, financial and technical) to ensure successful implementation of the EMPR, EA and all other relevant environmental commitments;
- Appoint a suitably qualified, competent Mine EO that will be responsible for among others, ensuring daily compliance with the EMPR, and EA and other relevant environmental standards throughout all phases of the mine;

- Appoint a suitably qualified, competent Environmental Control Officer (ECO) to verify environmental performance through regular audits;
- Notify authorities (e.g. DMR, DEA, DWA) of any significant changes in the mining operations which would require amendments to existing licences, authorisations, permits or other relevant approvals (such as this EMPR);
- Notify authorities of any reportable incidents in terms of National Legislation (e.g. Section 30 of NEMA, Section 20 of NWA);
- Review Independent Environmental Auditor reports (annual) and ECO compliance reports and ensure corrective actions are assigned to relevant parties for rectification;
- Ensure the projects' overall compliance with National Law and any relevant environmental standards and regulations;
- To implement the projects as per the approved project plan;
- To comply with special conditions as stipulated by surrounding Landowners during the negotiation process (if any).

16.2 THE MINE MANAGER

The Mine Manager is the individual responsible for the overall implementation of the project in respect of time, cost and legal provisions. This role is usually fulfilled by the applicant but may be designated to another third party (e.g. contractor, project engineer, etc.). The roles of the Mine Manager typically include the following:

- The Mine Manager acts on behalf of the Applicant regarding the administration of contracts;
- In consultation with the system Planning Engineer, determines the scope of work;
- Provides scheduling, aspects of co-ordination and estimating;
- Ensures implementation of the project plan within cost, time and quality constraints;
- Ensures that implementation of EMPR is executed as planned;
- Keeps the asset owner informed of progress made during the life cycle of the project; and
- Ensure that all pre-commencement conditions in the EMPR/EA are fulfilled before the Contractor occupies the site.

16.3 THE ENVIRONMENTAL CONTROL OFFICER

The ECO is appointed by the Applicant and should preferably be independent from the Applicant and the Contractor. The ECO must have appropriate training and experience in the implementation of environmental management specifications. In this regard, the ECO should have a tertiary qualification in an Environmental Sciences or Environmental Management field. The ECO should also have experience with environmental compliance monitoring and auditing, and preferably more than 3 years of such experience.

The ECO provides feedback to the Mine Manager regarding all environmental matters. The ECO's key role is auditing the implementation of the EMPR. The ECO also fulfils a function to communicate high importance environmental issues associated with the site to the Mine Manager. For the purposes of implementing the conditions contained herein, the Applicant should appoint the ECO well before (at least 2 weeks) the start of construction to ensure the pre-construction requirements included in this EMPR can be timeously implemented prior to construction. The ECO is responsible for the auditing function as well as the explanation of environmental issues contained in this EMPR to anyone working on the site if required. The Applicant shall ensure that contact numbers of the ECO and Mine EO are made available to the relevant authorities and Landowners prior to commencement of construction, and these parties shall be notified of any changes in these contact details.

The ECO roles include:

- Conduct environmental audits of the site and relevant documentation. The Audit frequency shall be monthly during all phases of the project;
- Review of the Mine EO's regular site inspection reports to ensure environmental issues on site are being adequately identified, recorded and addressed;
- Liaison between the Applicant, Contractors, authorities and other lead stakeholders on high importance environmental concerns where required;
- Conducting a pre-construction survey of the site prior to construction;
- Review the site induction training to ensure environmental issues receive adequate attention and important site specific issues are included;
- Verification that all environmental monitoring programs (sampling, measuring, recording etc. when specified) are carried out according to protocols and schedules; and
- Identification of any EMPR conditions which cannot be fully complied with and recommendations to the Applicant for addressing the root cause of such issues or for future review and update of the EMPR (also to be considered by the Independent Environmental Auditor during performance assessments).

16.4 THE MINE ENVIRONMENTAL OFFICER

The Applicant shall appoint a Mine Environmental Officer (Mine EO) who is a suitably qualified individual (and preferably be a senior member of staff) that will be responsible to oversee day to day compliance with the EMPR and ensure its correct implementation throughout the construction and operation of the facility. The Mine EO will also be responsible for correct implementation of other environmental commitments such as compliance with the EA, Permits, licenses and other relevant environmental procedures and documentation (e.g. method statements and monitoring programs). The Mine EO must have appropriate environmental training and experience to ensure adequate implementation of the EA, EMPR and relevant environmental norms and standards. In this regard, the Mine EO should have a tertiary qualification in an Environmental Sciences or Environmental Management field and experience with environmental management in the mining industry. The Mine EO is responsible for adequate environmental training of staff and employees throughout the operation of the facility.

The Mine EO roles will include:

- Conveying the contents of the EA, EMPR and any other relevant permits or approvals to the site employees (workers and staff) and discuss the contents in detail with Mine Manager and Contractor at a pre-construction meeting. This formal induction training shall be done with all main and sub-contractors. Record of the training date, meeting attendees and discussion points shall be kept by the Mine EO;
- Daily inspections of the work area(s) to ensure adequate on site environmental performance;
- Complete Site Inspection Forms on a regular basis (weekly) throughout the project;
- Review and approval of contractor's Environmental Method Statements;
- Auditing of the Contractors' environmental performance and documentation during the construction phase;
- Issuing of site instructions to the Contractor for corrective actions required;
- Ongoing environmental awareness training of the site personnel throughout the Operational phase;
- Maintain a record of environmental incidents (spills, impacts, injuries, complaints, legal transgressions etc.) as well as corrective and preventive actions taken, for submission to the Mine Manager and ECO;
- Maintain an external grievance register in which all complaints/grievances are recorded, as well as action taken, for submission to the Mine Manager and ECO;
- Ensure required corrective actions are taken within specified time frame in respect of non-conformances and environmental incidents;
- Attendance at all HSE meetings, toolbox talks and awareness training programs;
- Ensure that waste management on site conforms to the necessary requirements specified in this EMPR;

- Ensuring that environmental signage and barriers are correctly placed and maintained; and
- To inform and educate all employees about the environmental risks associated with their activities and how to avoid and mitigate significant impacts to the environment.

16.5 THE CONTRACTOR

The contractor is usually a third party appointed by the applicant to undertake the actual construction of the project. In some cases the mining may also be undertaken by contractors. The Contractor is answerable to the Mine Manager and ECO for all environmental issues associated with the project. Contractor performance will, amongst others, be assessed on health, safety and environmental management criteria. The principal contractor, any other contractors and sub-contractors will be required to comply with the provisions contained herein, and accordingly, the EMPR and its provisions must form part of any contractual arrangements between the applicant and contractors. The contractor must comply with EMPR during construction and ensure that all his employees and sub-contractors appointed by him are familiar with the EMPR. The legal accountability for correct implementation of the relevant requirements of the EA and EMPR must be contractually bound to the appointed contractor.

The Contractors role includes:

- Provide all necessary supervision during the execution of the project. He/ She should be available on site all the time;
- Appoint a suitably qualified, competent EO that will be responsible for among others, ensuring daily compliance with the EMPR, EA during the construction phase;
- To implement the projects as per the approved project plan;
- To ensure that implementation is conducted in an environmentally acceptable manner;
- To fulfill all obligations as per the agreed contract;
- To comply with special conditions as stipulated by surrounding Landowners during the negotiation process (if any);
- Ensure that the Contractors staff and employees have received the appropriate environmental awareness training prior to commencing construction; and
- Ensuring that environmental signage and barriers are correctly placed and maintained during the operational phase.

16.6 THE CONTRACTORS ENVIRONMENTAL OFFICER

The principle contractor shall appoint an Environmental Officer (EO), who is responsible for ensuring that construction activities comply with the requirements of the EA and EMPR during the construction phase. The Contractor must ensure that the Contractor's EO is suitably qualified and competent to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, workers, the ECO and the public. The Contractor's EO shall ensure that all sub-contractors working under the principle Contractor also abide by the requirements of the EA and EMPR.

The Contractor's EO roles will include:

- Preparing activity based Environmental Method Statements where required;
- Review the contractors safe work procedures/risk assessments/DSTI's (daily safe task instruction) during the construction phase and include information relating to the relevant environmental risks and appropriate mitigation measures;
- Support the Mine EO in monitoring by maintaining a permanent presence on site;
- Taking required corrective action within specified time frame in respect of non-conformances and environmental incidents;
- Assist in finding environmentally acceptable solutions to construction problems;
- Attendance at all SHE meetings, toolbox talks and induction programmes;
- Inspect the site as required to ensure adherence to the management actions of the EMPR on a daily basis;
- Complete a Site Inspection Checklist on a daily basis;
- Report any complaints/grievances to the Mine EO to be captured in the grievance register;
- Provide inputs to the regular environment reports to be prepared by the Mine EO and ECO;
- Liaise with the construction team on issues related to implementation of, and compliance with the EMPR;
- Day to day waste management; and
- Ensuring that environmental signage and barriers are correctly placed and maintained during construction.

17 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

Management of operational risk is a key consideration for Mines operating within the social and economic context of South Africa. Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. Operational risks and impacts are usually managed through the implementation of the Environmental and Social Management System (ESMS) and Safety, Health and Environmental (SHE) system. A formal, effective ESMS is an important requirement for establishing and maintaining effective environmental management and should be undertaken during the planning phase of the Project. As such the Applicant shall be required to appoint a suitably qualified specialist to develop the ESMS to be implemented on the mine prior to the onset of construction. Adequate resources (people, financial and technical) need to be made available to ensure effective establishment, implementation, maintenance and continual improvements of the ESMS. The roles and responsibilities for these key environmental personnel should be clearly defined and communicated throughout the organisation. The ESMS should include the requirement to constantly monitor environmental performance and assess the adequacy of environmental resources provided for the Mine. If required, the Mine would need to procure further environmental resources to ensure the successful implementation of the ESMS and EMPR. The development and implementation of an ESMS is a requirement in terms of compliance with international standards of best practise such as the IFC Performance Standards and Equator principles.

17.1 ESMS FRAMEWORK

The Leiden ESMS will be based on:

- Mashala Hendrina Coal corporate vision;
- South African legal requirements; and
- Mining best practice.

The ESMS to be developed for the Mine should incorporate and provide for:

- A project specific Environmental Policy;
- Organisational capacity and competency;
- The ESMS should identify roles and responsibilities of key role players;
- The ESMS should incorporate a mechanism for ongoing identification of risks and impacts (e.g. Impacts and aspects register of an ISO system).
- Integration of the ESMS with the SHE management system should be undertaken to form a holistic SHE risk management system;
- The ESMS should comprise appropriate management plans and procedures to ensure effective operational control;

- The ESMS should provide for emergency response and also make provision for emergency protocols;
- Effective communication (both internal and external) is a key requirement for successful implementation of the ESMS and an appropriate communication procedure to this effect should be developed;
- The ESMS should involve engagement between the client, its workers, local communities directly affected by the project (the affected communities) and where appropriate, other stakeholders. It is therefore imperative that there is integration between Stakeholder Engagement procedures and the ESMS;
- The ESMS should make provision for ongoing compliance monitoring, performance assessment and external audits; and
- The ESMS should make provision for internal auditing and continual improvement which should be incorporated into internal management review processes. The ESMS should provide for setting and reviewing objectives and targets to demonstrate continual SHE improvements associated with the project.

Ultimately an effective ESMS should provide for effective management of social and environmental risks and impacts whilst maintaining legal compliance and meeting international standards of best practise where these are feasible and appropriate.

17.2 STAKEHOLDER ENGAGEMENT

Social impacts occur immediately in the planning phase of a project and as such it is imperative to start with stakeholder engagement as early in the process as possible. Stakeholder Engagement commenced during the EIA Phase of the project, in accordance with the relevant legislation. Stakeholder Engagement is however required on an ongoing basis throughout the operation of the facility. As such, in the event that a mining right is granted, the mine will need to develop and implement a detailed Stakeholder Engagement Plan, designed to work as a living document for implementation over the entire LOM.

The following stakeholder engagement framework outlines the principles and objectives for stakeholder engagement during all phases of the mining operation.

- To identify and assess the processes and/or mechanisms that will improve the communication between local communities, the wider community and the Leiden Colliery;
- To improve relations between Leiden staff and the people living in the local communities;
- To provide a guideline for the dissemination of information crucial to the local communities in a timely, respectful and efficient manner; and

- To provide a format for the timely recollection of information from the local communities in such a way that the communities are included in the decision making process.

This stakeholder engagement plan will assist the Leiden Coal Mine to outline their approach towards communicating in the most efficient way possible with stakeholders throughout the life of the project. Such a plan cannot be considered a once off activity and should be updated on a yearly basis to ensure that it stays relevant and to capture new information. The Stakeholder Engagement Plan should be compiled in line with IFC Guidelines (IFC) and should consist of the following components:

- Stakeholder Identification and Analysis – time should be invested in identifying and prioritising stakeholders and assessing their interests and concerns.
- Information Disclosure – information must be communicated to stakeholders early in the decision-making process in ways that are meaningful and accessible, and this communication should be continued throughout the life of the project.
- Stakeholder Consultation – each consultation process should be planned out, consultation should be inclusive, the process should be documented and follow-up should be communicated.
- Negotiation and Partnerships – add value to mitigation or project benefits by forming strategic partnerships and for controversial and complex issues, enter into good faith negotiations that satisfy the interest of all parties.
- Grievance Management – accessible and responsive means for stakeholders to raise concerns and grievances about the project must be established throughout the life of the project.
- Stakeholder Involvement in Project Monitoring – directly affected stakeholders must be involved in monitoring project impacts, mitigation and benefits. External monitors must be involved where they can enhance transparency and credibility.
- Reporting to Stakeholders – report back to stakeholders on environmental, social and economic performance, both those consulted and those with more general interests in the project and parent company.
- Management Functions – sufficient capacity within the company must be built and maintained to manage processes of stakeholder engagement, track commitments and report on progress.

It is of critical importance that stakeholder engagement takes place in each phase of the project cycle and it must be noted that the approach will differ according to each phase.

17.2.1 GRIEVANCE MECHANISM

In accordance with international good practice the Leiden Coal Mine shall establish a specific mechanism for dealing with grievances. A grievance is a complaint or concern raised by an individual or organisation that judges that they have been adversely affected by the project during any stage of its development. Grievances may take the form of specific complaints for actual damages or injury, general concerns about project activities, incidents and impacts, or perceived impacts. The IFC standards require Grievance Mechanisms to provide a structured way of receiving and resolving grievances. Complaints should be addressed promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to all segments of affected communities, and is at no cost and without retribution. The mechanism should be appropriate to the scale of impacts and risks presented by a project and beneficial for both the company and stakeholders. The mechanism must not impede access to other judicial or administrative remedies.

The proposed grievance mechanism shall be based on the following principles:

- Transparency and fairness;
- Accessibility and cultural appropriateness;
- Openness and communication regularity;
- Written records;
- Dialogue and site visits; and
- Timely resolution.

Based on the principles described above, the grievance mechanism process involves four stages:

- Receiving and recording the grievance;
- Acknowledgement and registration;
- Site inspection and investigation; and
- Response.

17.3 INTERNAL GRIEVANCE PROCEDURE

The Mine shall develop a detailed internal grievance mechanism designed to receive and facilitate resolution of workplace concerns and grievances raised by employees (and their organizations, where they exist). Employees must be informed of the grievance mechanism at the time of recruitment and it must be made easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed. The mechanism should not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

17.4 DOCUMENT CONTROL

A formal document control system should be established during the development of the ESMS. The document control system must provide for the following requirements;

- Documents are approved for adequacy prior to use;
- Review and update documents as necessary and re-approve documents;
- Ensure that changes and the current version status of documents are identified;
- Ensure that relevant versions of applicable documents are available at points of use;
- Ensure that documents remain legible and readily identifiable;
- Ensure that documents of external origin necessary for the ESMS are identified and their distribution controlled; and
- Prevent unintended use of obsolete documents and apply suitable identification to them if they are retained for any purpose.

17.5 RECORD KEEPING

It is essential that an official procedure for control of records be developed to ensure records required to demonstrate conformity to environmental and social standards are maintained. The Applicant is therefore required to develop and maintain a procedure for the identification, storage, protection, retrieval, retention and disposal of records as part of the ESMS. Records must be legible, identifiable and traceable.

17.6 AUDITING AND REPORTING PROCEDURES

The Applicant shall develop and auditing and reporting procedure at the start of the project, for conveying information from the compliance monitoring activities and to ensure that management is able to take rapid corrective action should certain thresholds be exceeded. The sections below present a framework for the development of the necessary procedures.

Different reporting mechanisms may include:

- Inspections;
- Accidents and emergencies;
- Measuring performance indicators and interpreting and acting on the indicators;
- Records of monitoring activities to test the effectiveness of mitigation measures and impact controls, as well as for compliance auditing purposes; and
- Training programmes and evidence of appropriate levels/amount of skills/capacities created.

All monitoring and auditing must be accompanied by applicable records and evidence (e.g. delivery slips, photographic records, etc.). All reports must be retained and made available for inspection by the ECO, the Applicant and /or the Relevant Competent Authorities. All reports shall be signed by the relevant parties to ensure accountability. The applicant must use the audit report findings to continually ensure that environmental protection measures are working effectively on site through a system of self-checking. The EMP should be viewed as a dynamic document aimed at continual environmental performance improvement.

17.6.1 CONSTRUCTION PHASE

The following auditing and reporting shall be required throughout the construction phase:

- Daily Environmental Checklists: These checklists must be completed by the contractors' EO and must aim to monitor and report on day to day activities so as to ensure compliance with the relevant environmental commitments and environmental method statements. The EO shall submit the daily checklists to the Mine EO who shall identify corrective actions for any non-compliance or concerns identified;
- The Contractor's EO must review all safe work procedures/risk assessments from the safety department and include the relevant environmental risks and appropriate mitigation measures. Since the above procedures are specific to the applicable activity being undertaken, the inclusion of environmental measures aims to ensure each activity is undertaken in an environmentally responsible manner;
- Weekly Compliance Reports: These reports must be prepared by the designated Mine EO and must aim to monitor and report on-site environmental performance;
- Monthly Compliance Audits: These audits must be undertaken by the ECO and must aim to monitor and report on compliance with the requirements of the relevant authorisations, licences and permits, the approved EMPR; and
- Monthly Audit Reports: The ECO must compile monthly compliance reports (audits) which are to be submitted to the applicant for his review and correction of non-compliance issues. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified.

17.6.2 OPERATIONAL PHASE

The following auditing and reporting shall be required throughout the construction phase;

- Weekly Compliance Reports: These reports must be prepared by the designated Mine EO and must aim to monitor and report on-site environmental performance;
- Monthly Compliance Audits: These audits must be undertaken by the ECO and must aim to monitor and report on compliance with the requirements of the relevant authorisations. licences and permits, the approved EMPR; and

- Monthly Audit Reports: The ECO must compile quarterly compliance reports (audits) which are to be submitted to the applicant for his review and correction of non-compliance issues. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified.

17.7 RESPONDING TO NON COMPLIANCES

Non-compliance will be identified and managed through the following four key activities including;

- **Inspections** of the site and activities across the site;
- **Monitoring** of selected environmental quality variables;
- **Audits** of the site and relevant documentation as well as specific activities;
- **Reporting** on a monthly basis.

An environmental non-conformance and incident register must be prepared and maintained by the ECO throughout the lifespan of the mine in order to monitor environmental concerns, incidents, and non-conformances. The register must include details of date, location, description of the NC or Incident, applicable environmental commitment/standard, corrective action taken, adequacy of corrective action, date rectified, etc.

Non-compliance with the EMPR or any other environmental legislation, specifications or standards shall be recorded by the ECO in the non-conformance register. This register shall be maintained by the ECO and will be sent to the Applicant and Contractor on a regular basis (Monthly), and the Applicant shall ensure that the responsible party takes the necessary corrective actions. Non-conformances may only be closed out in the register by the ECO upon confirmation that adequate corrective action has been taken. The register should be utilised to measure overall environmental performance.

17.8 ENVIRONMENTAL INCIDENCES

For the purposes of this project, an environmental incident can be divided into three levels, i.e. major, medium and minor. All Major and Medium environmental incidents shall be recorded in the incident register. Minor incidents do not need to be reported, but require immediate rectification on site. Definitions and examples of environmental incidents are provided in Table 34 below;

Table 34: Description of incidents and non-conformances for the purpose of the project

Non-Conformance	Any deviation from work standards, practices, procedures, regulations, management system performance etc. that could either directly or indirectly lead to injury or illness, property damage, damage to the workplace environment, or a combination of these.

Major Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread, long-term, irreversible significant negative impact on the environment and/or has a high risk of legal liability. A major environmental incident usually results in a significant pollution and may entail risk of public danger. Major environmental incidents usually remain an irreversible impact even with the involvement of long-term external intervention i.e. expertise, best available technology, remedial actions, excessive financial cost etc. Major environmental incidents may be required to be reported to the authorities. The ECO shall make the final decision as to whether a particular incident should be classified as a Major incident. An example of a Major environmental incident would be a significant spillage (e.g. 500 litres) of fuel into a watercourse.
Medium Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread or localised, short term, reversible significant negative impact on the environment and/or has a risk of legal liability. A medium environmental incident may be reported to the authorities, can result in significant pollution or may entail risk of public danger. The impact of medium environmental incidents should be reversible within a short to medium term with or without intervention. The ECO shall make the final decision as to whether a particular incident should be classified as a Medium incident. An example of a Medium environmental incident would be a large spill of fuel (e.g. 20 – 50 litres) onto land.
Minor Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, where the environmental impact is negligible immediately after occurrence and/or once-off intervention on the day of occurrence. An incident where there is unnecessary wastage of a natural resource is also classified as a minor environmental incident. An example would be leaking water pipes that result in the wastage of water. A minor environmental incident is not reportable to authorities. An example of a minor incident is day to day spills of fuel or oil onto the ground where the spill is less than one or two litres. Minor incidents are easily rectified and shall be addressed immediately after being identified on site.

The following incident reporting procedures shall apply to this project:

- All environmental incidents shall be reported to Contractor's EO and Mine EO who shall ensure that the appropriate rectification is undertaken;
- The Mine EO shall record all medium and major incidents in the incident register and advise on the appropriate measures and timeframes for corrective action;

- An incident report shall be completed by party responsible for the incident for all medium and major incidents and the report shall be submitted to the Mine Manager and Mine EO within 5 calendar days of the incident;
- The Mine EO shall investigate all medium and minor incidents and identify any required actions to prevent a recurrence of such incidents;
- In the event of an emergency incident (unexpected sudden occurrence), including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the Applicant shall notify the relevant authorities in accordance with legal requirements (e.g. Section 30 of NEMA and Section 20 of the NWA). In the event of a dispute in terms of the classification of a such an incident, the Applicant shall engage the ECO to advise on the potential reporting requirements in terms of the above.

18 REVIEW AND REVISION OF THE EMPR

It is important to note that this EMPR is made legally binding on the applicant at such time as the EA and/or WML is granted and the EMPR is approved by the decision making authority. Since this is a mining project, the overarching legislation is the MPRDA, and it is important to note that in accordance with Section 102 of the MPRDA, no EMPR may be amended or varied without the written consent of the minister. It is however also important to consider that the EMPR is a dynamic document which may require such alteration and /or amendment as the project evolves. Conditions under which the EMPR would require revision include:

- Changes in legislation;
- Occurrence of unanticipated impacts or impacts of greater intensity, extent and significance than predicted;
- Inadequate mitigation measures (i.e. where environmental performance does not meet the required level despite the implementation of the mitigation measure); and
- Secondary impacts occur as a result of the mitigation measures.

The Applicant in consultation with the ECO should be responsible for ensuring that the registration and updating of all relevant EMPR documentation is carried out. It shall be the responsibility of the Applicant/Mine Manager to ensure that all personnel are performing according to the requirements of this procedure and to initiate the revision of controlled documents, when required by changes in process or operations and shall notify the ECO of such changes.

It is recommended that a risk assessment protocol must be developed and implemented by the ECO which shall be utilised to evaluate the environmental risk associated with the potential proposed alterations and/or amendments. The results of the risk assessment must then be included in the submission to the competent authority for the amendment process. it is important to note that if alterations and/or amendments are required, these may only be effected with written approval from the competent authority and in accordance with the then-in-effect relevant legal processes.

19 ENVIRONMENTAL AWARENESS PLAN AND TRAINING

Training and environmental awareness is an integral part of a complete EMPR. The overall aim of the training will be to ensure that all site staff are informed of their relevant requirements and obligations pertaining to the relevant authorisations, licences, permits and the approved EMPR and protection of the environment.

The applicant and contractor must ensure that all relevant employees are trained and capable of carrying out their duties in an environmentally responsible and compliant manner, and are capable of complying with the relevant environmental requirements. To obtain buy-in from staff, individual employees need to be involved in:

- Identifying the relevant risk;
- Understanding the nature of risks;
- Devising risk controls; and
- Given incentive to implement the controls in terms of legal obligations.

The applicant shall ensure that adequate environmental training takes place. All employees shall have been given an induction presentation on environmental awareness. Where possible, the presentation needs to be conducted in the language of the employees. All training must be formally recorded and attendance registers retained. The environmental training should, as a minimum, include the following:

- General background and definition to the environment;
- The importance of compliance with all environmental policies;
- The environmental impacts, actual or potential, of their work activities;
- Compliance with mitigation measures proposed for sensitive areas;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving compliance with the environmental policy and procedures and with the requirement of the applicant's environmental management systems, including emergency preparedness and response requirements;
- The potential consequences (legal and/or other) of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying out their work activities; and

- All operational risks must be identified and processes established to mitigate such risk, proactively. Thus the applicant needs to inform the employees of any environmental risks that may result from their work, and how these risks must be dealt with in order to avoid pollution and/or degradation of the environment.

In the case of permanent staff required during the operational phase of the project, the applicant / contractor shall provide evidence that such induction courses have been presented. In the case of new staff (including contract labour) the contractor / applicant shall keep a record of adequate environmental induction training.

19.1 CONSTRUCTION PHASE

The specific requirements for environmental training include:

- Environmental Induction Training: All general workers must receive induction training which shall be presented by the Contractors Health and Safety Manager Representatives. The induction training must include an environmental management component which will be will be prepared by the Contractor's EO and presented where possible by the Contractor's EO. The training material must include general environmental awareness and an overview of the approved EMPR and applicable authorisations, licences and permits.The Induction Training Material must be reviewed and approved by the ECO;
- Weekly Environmental Toolbox Talks: Environmental toolbox talks will be prepared by the Contractor's EO to cover a range of environmental topics and must be presented to relevant staff during applicable times during construction process. The aim of these toolbox talks will be to inform site employees of general environmental requirements pertaining to specific activities, as well as specific EMPR and EA requirements and obligations. The ECO shall review environmental toolbox talks on a periodic basis to ensure the material is relevant and appropriate;
- Informal training of all staff on site is also required on an on-going basis through informal discussions, on-site supervision and through facilitation of day to day activities. Such training must be given or otherwise facilitated by the Contractor's EO; and
- The Contractor's EO must review all safe work procedures/risk assessments/DSTI's (daily safe task instruction) from the safety department and include the relevant environmental risks and appropriate mitigation measures. Since the above procedures are specific to the applicable activity being undertaken, the inclusion of environmental measures aims to ensure each activity is undertaken in an environmentally responsible manner.

19.2 OPERATIONAL PHASE, DECOMMISSIONING PHASE, AND REHABILITATION

The specific requirements for environmental training include:

- Site Environmental Induction Training: All site staff and employees will receive induction training which will be presented by the Health and Safety Manager Representatives. The induction training must include an environmental management component which will be will be prepared by the Mine EO and presented where possible by the Mine EO. The training material must include general environmental awareness and an overview of the EMPR and EA requirements. The Induction Training Material must be reviewed and approved by the ECO;
- Regular Environmental Toolbox Talks: Environmental toolbox talks will be prepared by the Mine EO to cover a range of environmental topics and must be presented to relevant staff during applicable times during all relevant phases. The aim of these toolbox talks will be to inform site employees of environmental requirements pertaining to specific activities, as well as specific EMPR and EA requirements and obligations; and
- Informal training of all staff on site is also required on an on-going basis through informal discussions, on-site supervision and through facilitation of day to day activities. Such training must be given or otherwise facilitated by the Mine EO.

20 PROCEDURE FOR ENVIRONMENTAL EMERGENCIES AND REMEDIATION

The Applicant must identify potential emergencies and develop procedures for preventing and responding to them. There are several options for dealing with high priority impacts and risks, as the paradigm has two components, probability and consequence. The design of control measures rest on the understanding the cause and effect. Best practise is to intervene with the ultimate factors were feasible, rather than treat the outcomes. Emergency response therefore has the option of reducing probability, or reducing the consequence, reducing the probability is the preferred option. Below are some common emergency preparedness approaches:

- Threat consequence if and when the risk eventuates, when the risk becomes an issue;
- Combine reducing the probability and treating the consequence;
- Offset environmental losses by investing in other assets;
- Not manage some of the risks because there are too many; and

- Make provision to manage residual impacts or issues that arise because of shortcomings in risk identification and rating, avoidance and mitigation or because a rare event has occurred.

Residual impacts are those impacts that despite reducing the probability and consequence might still occur. In these cases parties will have to be compensated, pollution cleaned up and damage to the environment remediated.

The Applicant shall be required to develop and implement an Emergency Preparedness and Response Plan prior to commencing work. The Emergency Preparedness and Response Plan should be based on a baseline Hazard and Risk Assessment and should provide for the following as a minimum:

- Risk assessment (identification of areas where accidents and emergency situations may occur, communities and individuals that may be impacted);
- Response procedures;
- Provision of equipment and resources;
- Designation of responsibilities;
- Communication and reporting (including that with potentially Affected Communities)
- Periodic training to ensure effective response;
- Periodic review and revision, as necessary, to reflect changing conditions.

The Applicant must ensure that the Emergency Preparedness and Response Plan makes provision for environmental emergencies, including, but not limited to;

- Fire Prevention;
- Fire Emergency Response;
- Spill prevention;
- Spill Response;
- Contamination of a water resource;
- Accidents to employees; and
- Use of hazardous substances and materials, etc.

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

20.1 FIRE

Fires represent a significant risk to mining operations, particularly on the Highveld and require special attention in the Emergency Response Plan. Sparks generated during welding, cutting of metal or gas cutting can result in fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. The contractor/Applicant must take all reasonable measures to ensure that fires are not started as a result of activities on site. No smoking is allowed near containers with flammable contents or at areas that are highly flammable. Smoking is only permitted at areas designated for smoking. No open fires are permitted on site and no burning of waste is to be allowed on site. The contractor/Applicant shall ensure that there is sufficient fire fighting equipment available on site at all times. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities. The contractor/Applicant is to ensure that he/she has the contact details of the nearest fire station in case of an emergency. Appropriate and correctly serviced equipment must be available for all activities that are likely to generate fire.

It is further anticipated that firebreaks will be required around the site perimeter. It is recommended that such fire prevention measures are implemented in consultation with adjacent landowners and where necessary that the Applicant coordinate fire prevention efforts with local FPA.

20.2 HEALTH AND SAFETY

The Applicant and Contractor shall make allowance for the supply, erection, maintenance and removal of the information boards. Information boards shall also provide the name of the process managers, relevant contact person and contact number. This will ensure that the public access to request information and/or to lodge any complaints. The boards will essentially be to advise the public of the construction activities to be undertaken, or being undertaken and to advise of the prohibition of entering demarcated “no-go” areas.

The Applicant and Contractor must ensure that compliance with the Mine Health and Safety Act (Act No. 29 of 1996) and the Occupational Health and Safety Act (Act No. 85 of 1993) is strictly adhered to. All reasonable measures must be taken to ensure the safety of all site staff and the surrounding community is not compromised. No weapons may be brought onto the property by any person. Where fencing is temporarily affected, temporary security must be provided at all times until the fence is reinstated.

The Applicant and Contractor must ensure that all vehicles using public roads are in a roadworthy condition, that drivers adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to. The contractor shall make provision for flagmen to regulate traffic and construction vehicles when necessary.

The Applicant and Contractor must ensure that all accidents and incidents are recorded and reported to the ECO. The Applicant/ contractor must have easy access to all relevant emergency numbers for example, spill response teams, fire authorities, fire protection associations, medical emergency, nearest emergency rooms (hospitals) to the site, of both private and public hospitals. The Applicant and Contractor must take all reasonable measures to ensure the health and safety of all employees, visitors and the public.

20.3 SPILL RESPONSE PROCEDURE

All employees, staff and labourers must be instructed regarding implementation of spill prevention measures and spill response procedures. In the event of a spill, the following general requirements shall apply and the detailed spill procedure must cater for these requirements;

- Immediately reporting of spills by all employees and/or visitors to the relevant supervisor and EO (this requirement must be including in induction training);
- Take immediate action to contain or stop the spill where it is safe to do so;
- Contain the spill and prevent its further spread (e.g. earth berm or oil absorbent materials for spill to land or by deploying booms and/or absorbent material for a spill to water);
- Dispose of any contaminated soil or materials according to appropriate waste disposal procedure. Note: Waste from spills of hazardous materials shall be disposed of as hazardous waste at a suitably licensed waste disposal facility;
- The Contractor's EO and Mine EO shall record details of the spill in their respective incident registers;
- Photographic evidence shall be obtained of the spill cleanup.

In the case of large spills, the services of a specialist spill response agency shall be required, who shall advise on appropriate cleanup procedures and follow-up monitoring (if required).

In the event of any spills which are classified as medium or major incidents, the Mine EO shall immediately inform the ECO. The ECO shall record the incident in the ECO's non-conformance and incident register and advise on the appropriate measures and timeframes for corrective action. Environmental incident reports shall be completed and submitted to the Mine Manger and ECO within 5 working days for all medium and major incidents. If there is a requirement to report the incident to the authorities, this shall be done by the Applicant in consultation with the ECO.

The Applicant must also, (as per Section 30 of the NEMA) notify the Director-General (DWA, DEA and DMR), South African Police Services, MDEDET and Local Municipality and any persons whose health may be affected of the nature of an incident including:

- Any risks posed to public health, safety and property,
- Toxicity of the substance or by products released by the incident and

- Any step taken to avoid or minimise the effects of the incident on public health and the environment

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

20.4 MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION

The broad measures to control or remedy any causes of pollution or environmental degradation as a result of the proposed activities taking place on the Leiden Coal Mine are provided below:

- Limit the size of the area to be disturbed as far as is practically possible;
- Design and construct infrastructure such as the PCD and Pit dewatering dams with both decant and drainage systems inclusive of storm water runoff measures;
- Conduct regular dam inspections in line with the regulatory requirements;
- Design and construct waste rock dumps and overburden dumps with adequate storm water runoff measures;
- Establish and maintain dirty and clean water systems in line with the regulatory requirements;
- Treat all contaminated water prior to discharge;
- Contain potential pollutants and contaminants (where possible) at source;
- Handling of potential pollutants and contaminants (where possible) must be conducted in bunded areas and on impermeable substrates;
- Ensure the timeous clean-up of any spills;
- Implement a waste management system for all waste stream present on site';
- Investigate any I&AP claims of pollution or contamination as a result of mining activities;
- Continue with concurrent rehabilitation;
- Operate the mine in line with the proposed closure goals and objectives;
- Rehabilitate the proposed mining site in line with the requirements of the detailed rehabilitation and closure plan; and
- Implement the action plans and technical management options described in Section 21 below.

It is of critical importance that the broad measures to control or remedy any causes of pollution or environmental degradation are applied during all phases of the proposed mining operation. This is essential and allows for the operation to be conducted in a manner that will allow for the post mining closure goals and objectives to be met.

21 ACTION PLANS TO ACHIEVE OBJECTIVES AND GOALS AND TECHNICAL OR MANAGEMENT OPTIONS FOR IMPACTS

The final environmental significance scores presented in the Action Plan are for the preferred Alternative 3 – Sensitivity Planning Approach.

21.1 GENERAL

IMPLEMENTATION PLAN					
Phase	**Management Action**	**Timeframe for Implementation**	**Review/Repeat frequency**	**Responsible Party For Implementation**	**Responsible Party For Monitoring and Review**
Planning	Develop a detailed Health and Safety Plan in accordance with relevant legislation and standards	1 month prior to onset of construction	Annual internal review	Health and Safety personnel to be appointed	Environmental Manager (annual internal review) Independent Environmental Auditor (Annual)
	Develop an Access control protocol	1 month prior to onset of construction	Annual internal review	Security personnel to be appointed	Environmental Manager (annual internal review) Independent Environmental Auditor (Annual)
	Undertake required pre-construction surveys	1 month prior to onset of construction	Annual internal review	Environmental personnel to be appointed	Environmental Manager (annual internal review) Independent Environmental Auditor (Annual)
	Develop the ESMS including all relevant plans, procedures and policies	1 month prior to onset of construction	Annual internal review	Environmental personnel to be appointed	Environmental Manager (annual internal review) Independent Environmental Auditor (Annual)
	Appoint all relevant environmental personnel	1 month prior to onset of construction	Annual internal review	Environmental personnel to be appointed	Environmental Manager (annual internal review) Independent Environmental Auditor (Annual)
Construction	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Review and update plans, procedures and policies as required	Annually	Applicant	Applicant	Environmental Manager (annual internal review) ECO (External review as required
Operation	Implement technical	Throughout operation	Environmental Officer	Applicant	Mine EO (Weekly) ECO

	management measures as per EMP		(weekly)		(Monthly audit) Independent Environmental Auditor (Annual)
	Review and update plans , procedures and policies as required	Annually	Applicant	Applicant	Environmental Manager (annual internal review) ECO (External review as required
Decommissioning	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation and Closure	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
1. Legal Compliance							
A	The Applicant shall identify and comply with all relevant national, provincial and local legislation, including associated regulations and bylaws and shall establish and maintain procedures to keep track of, document and ensure compliance with environmental legislative changes.	Construction Operation Decommissioning Rehab & Closure	Prior to construction & ongoing until closure	Applicant Mine EO	ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure compliance with relevant legislation.	Confirmation that legal register is in place and up-to-date. (Legal register) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	Should there be changes in legislation and/or regulations the Applicant shall take the necessary actions to incorporate such changes and to pass these requirements on to the Contractors.	Construction Operation Decommissioning Rehab & Closure	Prior to construction & ongoing until closure	Applicant ECO	ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure compliance with relevant legislation/Confirmation that requirements in terms of updated legislation are passed onto the contractors.	Legal Compliance Audits (Contractors contractual agreements) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The Applicant shall ensure that the area directly affected by mining is appropriately zoned in accordance the	Planning Rehab and Closure	Prior to construction and post-closure	Applicant	ECO (Once-Off) Independent	Ensure compliance with land zoning regulations.	(Legal register) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	applicable zoning regulations in force both pre-mining and post-mining.				Environmental Auditor (Annual)		
2. Environmental and Social Management System							
A	The Applicant shall develop an effective Environmental and Social Management System (ESMS) that is appropriate to the nature and scale of the project. The ESMS should include and provide for the following as a minimum: • Environmental Policy; • Ongoing Identification of risks and impacts; • Social and Environmental Management programs; • Organisational capacity and competency; • Emergency preparedness; • Stakeholder engagement; • Monitoring and review.	Planning Construction Operation Decommissioning Rehab & Closure	ESMS to be developed prior to the onset of construction	Applicant	Applicant (Annual) Independent Environmental Auditor (Annual)	Promote sound and sustainable environmental and social performance	(ECO Monthly Checklist/Report) (Incident Register) (Grievance register)
B	The Applicant shall develop and implement social and environmental plans and procedures to support the successful implementation of the ESMS. The ESMS shall dictate which plans and procedures are required, but the plans and procedures must provide for the following: • Stakeholder Engagement; • Grievance Mechanism; • Ongoing risk and impact identification; • Management targets and objectives; • Resources, Roles, Responsibility and Authority; • Legal compliance (maintenance of legal register) • Compliance monitoring; • Environmental Auditing procedures;	Planning Construction Operation Decommissioning Rehab & Closure	Procedures to be developed prior to the onset of construction	Applicant	Applicant (Annual) Independent Environmental Auditor (Annual)	Promote sound and sustainable environmental and social performance	Sound environmental performance (annual performance assessment) (ECO Monthly Checklist/Report) (Incident Register) (Grievance register) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	• Competence Training; • Environmental awareness training; • Environmental Document and Record Control • Emergency Preparedness and Response; • Requirements for Contractors; • Surface Disturbance Management; • Heritage resource management (including chance finds procedures); • Biodiversity Management; • Management of Weeds, Pests, Alien and Invasive Plant Species (including Herbicides, Pesticides and Insecticide Management) • Hazardous Substances Management (including Fuel and Oil Off loading and Refuelling); • Water Management; • Waste Management; • Environmental Aspect Monitoring (water quality and quantity, air quality, noise monitoring etc.); • Non-conformity and Incident Reporting.						
C	The Applicant shall ensure that Social and Environmental human resources have the knowledge, skills, and experience necessary to perform their work with competence and efficiency.	Planning Construction Operation Decommissioning Rehab & Closure	Prior to construction & ongoing until closure	Applicant	Applicant (Annual) Independent Environmental Auditor (Annual)	Promote sound and sustainable environmental and social performance	Sound environmental performance (Annual Performance Assessment Reports)
3. Stakeholder Engagement							
A	The Applicant shall develop and implement a Stakeholder Engagement Plan prior to the onset of construction. The Plan shall include and provide for the following as a minimum: • detailed plan of how the identified affected communities/stakeholders are to be contacted.	Planning Construction Operation Decommissioning Rehab & Closure	Procedures to be developed prior to the onset of construction	Applicant	Applicant (Annual) Independent Environmental Auditor (Annual)	Promote sound and sustainable environmental and social performance	(ECO Monthly Checklist/Report) (Incident Register) (Grievance register) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	• details of the methods to be used to communicate with the identified stakeholders. • A list of information to be provided to stakeholders at each project phase; • The method of determining the preferred language of each of the affected communities must be detailed along with the methods to be used to ensure that the preferred languages are utilised in this communication. • The plan must describe the method to be utilised to cater for any disadvantaged and vulnerable groups' inclusion in the stakeholder engagement process. • The method for capturing and addressing the views from both men and women in the affected communities must be detailed. • The frequency of consulting with and reporting to stakeholders must be provided. • The plan must describe the method of incorporation of comments received from stakeholders into action plans and mitigation measures. • The documentation to be created to record the issues raised during the stakeholder engagement process and the frequency of these reports must be detailed. This must include the frequency and methods of distributing these records to the stakeholders.						
4. Appointment of ECO							
A	The Applicant shall appoint a suitably qualified and competent ECO who	Planning	Prior to construction	Applicant	Independent Environmental	Appoint ECO to ensure monitoring and successful	Confirmation that ECO has been appointed and is

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	shall preferably be independent from the Applicant and the Contractor. The ECO must preferably have a tertiary qualification in an Environmental Management or appropriate field. The ECO should have appropriate qualification and experience in the implementation of environmental management specifications. For the purposes of implementing the conditions contained herein, the Applicant should appoint the ECO well before (at least 2 weeks) the start of construction to ensure the pre-construction requirements included in this EMPR can be timeously implemented prior to construction. The Applicant shall provide the ECO with the necessary support to ensure that the environmental aspects relating to the development is adhered to.				Auditor (Annual)	implementation of the EMPR.	suitably qualified to perform the duties contained in this EMPR. (ECO appointment) (Annual Performance Assessment Reports)
B	The Applicant is responsible for the maintenance, update and review of the EMPR if required. The ECO shall include any recommendations for proposed amendments/alterations of the EMPR to the Applicant who shall engage the competent authority with regards to such changes. Only on written approval from the competent authority may such changes be effected in accordance with the provisions of the MPRDA.	Planning Construction Operation Decommissioning Rehab & Closure	As required	ECO	Independent Environmental Auditor (Annual) (Annually)	Ensure EMPR is reviewed and updated where necessary to ensure adequate mitigation for all impacts associated with the operation.	Audit results and recommendations (Annual Performance Assessment Reports) (ECO Monthly Checklist/Report)
5. Appointment of Contractor							
A	The EMPR must be made binding on the contractor(s) and should be included in tender documentation for the mining contract. The costs related to the implementation of the EMPR during construction must be provided for in the contract.	Planning Construction Operation Decommissioning Rehab & Closure	Prior to construction and Ongoing	Applicant Contractors	ECO (Once-off) Independent Environmental Auditor (Annual)	Ensure that the contractor implements all the mitigation measures as described in the EMPR.	Confirmation that contractor has received EMPR and that EMPR has been made contractually binding. (Contractual agreements) (ECO Monthly

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							Checklist/Report) (Annual Performance Assessment Reports)
B	All contractors and sub-contractors must have a copy of this EMPR at the point of use and should be briefed by the Mine EO or ECO with regards to the use and implementation of the EMPR.	Planning Construction Operation Decommissioning Rehab & Closure	Prior to construction and Ongoing	Contractor	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure all contractors are aware of EMPR requirements.	Confirmation that contractors have received training relating to EMPR implementation. (Training records) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The Principle Contractor shall appoint a dedicated Contractor's EO who is suitably qualified to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the ECO and the public. The Contractor's EO shall be appointed prior to the onset of construction.	Planning	Prior to construction and Ongoing	Contractor	ECO (Once-off) Independent Environmental Auditor (Annual)	Ensure a suitably EO is present on site to oversee day to day activities and ensure successful implementation of EMPR during construction.	Confirmation that EO has been appointed and is suitably qualified to perform the necessary duties contained in this EMPR. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	The Principle Contractor shall ensure that all sub-contractors working under the contractor abide by the requirements of the EMPR through the inclusion of the EMPR and applicable environmental requirements in contractual agreements for all sub-contractors.	Construction Operation Decommissioning Rehab & Closure	Ongoing	Contractor	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure that the contractor implements all the mitigation measures as described in the EMPR.	Confirmation that all contractors and sub-contractors abide by EMPR provisions. (Mine EO weekly checklist) (ECO Monthly checklist) (Annual Performance Assessment Reports)
E	Where required for successful implementation of this EMPR and the ESMS, the Applicant shall include social and community requirements in contracts with contractors.	Planning & design Construction Operation Decommission Closure & rehab	Before any activities start on site and continue for the life of the mine	Applicant Sub-contractors	HR manager Contracts manager As required	Ensure social and community requirements are adequately implemented on site.	Clause in sub-contractors contracts (Mine EO Weekly Report) (ECO Monthly checklist) (Annual Performance Assessment Reports)
			6. Service Detection				
A	The contractor shall engage the	Construction	Prior to	Applicant	ECO (Once-off)	Ensure no damage or	Results of service

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	Applicant with regards to any existing services on the site prior to surface disturbance. The contractor must take all reasonable measures to ensure the location of underground and above-ground services are identified and damage or interruptions to such services are avoided.	Operation Decommissioning Rehab & Closure	construction and ongoing	Contractor	Independent Environmental Auditor (Annual)	disruption to existing services.	detection Incident register indicating disruption to services (Mine EO weekly checklist) (ECO Monthly checklist) (Incident Register) (Grievance register) (Annual Performance Assessment Reports)
B	In the event that construction or operations must be located near to existing services, thorough service detection should be undertaken and services exposed in the area to be disturbed to ensure there is no damage or disruption to services. Where appropriate, suitable buffer zones should be fenced off or demarcated around such areas to prevent any damage as a result of construction or operational activities.	Construction	Prior to construction and ongoing	Applicant Contractor	Mine EO (weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure no damage or disruption to existing services.	Results of service detection Incident register indicating disruption to services (Mine EO weekly checklist) (ECO Monthly checklist) (Incident Register) (Grievance register) (Annual Performance Assessment Reports)
C	In all cases where services must be temporarily disrupted, the relevant landowner and/or affected parties must be notified timeously (at least two weeks prior) prior to the service disruption.	Construction	Ongoing	Applicant Contractor	Mine EO (weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Maintain good relations with affected landowners.	Affected parties/Verification that relevant parties have been timeously notified prior to disruption of services. (Mine EO weekly checklist) ECO Monthly checklist) (Annual Performance Assessment Reports)
7. Safety							
A	The Applicant shall ensure: • That reasonable measures are taken to ensure the safety of all site staff; • Provide appropriate Personal Protective Equipment (PPE) where required;	Construction Operation Decommissioning Rehab & Closure	Ongoing	Applicant Contractor	Safety Department	Ensure compliance with legal provisions of OHSA, MHSA and regulations.	No safety incidents (safety reports)

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	• Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) and associated regulations; • Compliance with the Mine Health and Safety Act (Act 29 of 1996) as amended and associated regulations; • That all construction vehicles using public roads are in a roadworthy condition, that they adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to; • That all accidents and incidents are recorded and reported to the Mine manager and EO/ECO; and • The Applicant and Contractor must ensure that he/she has the contact details of the nearest emergency rooms (hospitals) to the site, of both private and public hospitals.						
8. Emergency Response							
A	The Applicant shall develop and implement an Emergency Preparedness and Response Plan which shall include and provide for the following as a minimum: • Risk assessment; • Response procedures; • Provision of equipment and resources; • Designation of responsibilities;; • Communication and reporting (including that with potentially Affected Communities) • Periodic training to ensure effective response; • Periodic review and revision, as	Planning	Development of Plan prior to construction. Implementation ongoing until closure.	Applicant	ECO (Once-off)	Ensure emergency preparedness and response systems in place.	Verification that emergency procedures are in place and approved (ECO Monthly Report) (Emergency Preparedness and Response Plan) (Emergency Drill Reports) (Incident Reports)

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	necessary, to reflect changing conditions.						
B	The necessary provisions (financial, resources, materials) shall be made in order to ensure compliance with the Emergency Preparedness and Response Plan.	Planning Construction Operation Decommissioning Rehab & Closure	Ongoing	Applicant	Applicant (Annually) Independent Environmental Auditor (Annual)	Ensure adequate provision of resources for emergency preparedness and response	Verification that sufficient OPEX is provided for Emergency Preparedness and Response (OPEX provided for Emergency preparedness and response) (Annual Performance Assessment Reports)
C	The Mine shall obtain emergency contact details for a specialist spill response agency that services the area and shall inform them about the project and request them formally to plan for the extension of their services.	Planning	Prior to construction	Applicant	ECO (Once-off)	Ensure prompt spill response in the event of a major spillage.	Verification that specialist spill response agency has been engaged and is prepared to extend their services in the event of a major incident. (ECO Monthly Report)
E	The Applicant shall officially approach the police, inform them about the project and request them formally to plan for the extension of their services.	Planning	Prior to construction	Applicant	ECO (Once-off) Independent Environmental Auditor (Once-off)	Channels of communication setup with police services to allow for speedy response in an emergency.	(ECO Monthly Report) (Annual Performance Assessment Reports)
9. Fire Prevention							
A	The Applicant and ECO shall assess the risk of on-coming fires and where required the Applicant shall ensure that fire breaks are created prior to the onset of construction. The creation of fire breaks shall be undertaken in accordance with relevant legislation consultation with surrounding landowners and the local fire control association. Fires breaks must be maintained as necessary to ensure they remain effective.	Planning Construction Operation Decommissioning Rehab and Closure	Prior to construction and Ongoing	Applicant ECO Contractor	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Protect site and adjacent properties from oncoming veld fires.	Verification that appropriate fire prevention measures, are in place where required. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
B	The Mine shall become a member of the local fire association and have fire-fighting equipment on site.	Planning & design Construction Operation	Before any activities start on site and continue for the life of the	Applicant	Safety officer CLO As required	Become an active member of community and manage risks to applicant and neighbours	Membership of fire association Fire-fighting equipment (Mine EO Weekly Report)

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		Decommission Closure & rehab	mine				(ECO Monthly Report) (Annual Performance Assessment Reports)
10. Site access, Security and Traffic Management							
A	Access to the site must be controlled to restrict unauthorised personnel from entering the site. Only authorised personnel shall be allowed on site.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No contamination of topsoil.	Visual inspection of topsoil stockpiles. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
B	On-site vehicles must be limited to approved access routes and areas (including turning circles and parking) on the site so as to minimise excessive environmental disturbance to the soil and vegetation off site, and to minimise disruption of traffic.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise footprint of environmental impact.	Visual observation of vehicle access. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
C	Site vehicles are only permitted within the demarcated construction camp or construction site as required to complete their specific task. The contractor must ensure that all staff his/her staff and employees remain within the demarcated construction site at all times.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise footprint of environmental impact.	Visual observation of vehicle access. (Mine EO weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
D	Any new access (if required) shall first be approved by the Mine Manager and ECO (method statement may be required) and should be provided with erosion and silt pollution prevention measures where required.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure adequate placement (avoid sensitive areas) and design of access tracks/apply mitigation for erosion.	Approval of access roads Method Statements (Mine EO weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
E	Construction workers shall not be allowed to receive visitors while they are within the construction site. The Labourers on site must retain some means of identification.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent	Limit potential for security risk.	No security incidents (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)

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					Environmental Auditor (Annual)		(Incident reports)
F	No person will be allowed to keep or use alcohol, recreational drugs, traditional or modern weapons, snares or otherwise dangerous objects on-site, or to enter the site while under the influence of alcohol or drugs.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure safety and security are maintained on site.	No incidents (Site induction material) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports) (Incident reports)
G	Staff, employees and construction workers will not be allowed to keep (or have in their possession at any point in time) any animals, including livestock, poultry, wildlife or pets.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Avoid public nuisance, introducing foreign species/diseases to area and unsanitary conditions.	Visual confirmation of no domestic animals on site (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
H	If imported sand, stone, or aggregate material is used in the construction or upgrading of access roads (or for any other purpose, this material shall be obtained from a legal source. The contractor shall inspect the premises of any prospective suppliers of such material and shall only utilise a supplier that conducts itself in an environmentally responsible manner. A copy of the relevant mining permits/right shall be obtained from the supplier and kept on record for auditing purposes.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure construction materials obtained from legal source to ensure legal compliance.	Legal audit findings and recommendations No illegal sources of sand/stone/aggregate (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
I	All employees and visitors to the site must undergo a site induction which shall include basic environmental awareness and site specific environmental requirements (e.g. site sensitivities and relevant protocols/procedures). This induction should be presented or otherwise facilitated by the Contractors EO/Mine EO wherever possible.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure visitors are aware of site environmental sensitivities, and procedures.	Verification that awareness training is undertaken. (Induction training registers) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)

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J	In the case of dual or multiple use of roads by other users, arrangements for multiple responsibility must be made with the other users. If not, the maintenance of access roads will be the responsibility of the Applicant and/or Contractor(s). Road condition must be assessed regularly for signs of damage.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department (weekly) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit safety risk due to damaged roads.	Visual observation of road condition. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
K	Damage caused to public roads as a result of the construction and/or mining activities shall be repaired in consultation with the relevant municipal authorities.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department (weekly) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit safety risk due to damaged roads.	Visual observation of road condition. Verification that damaged roads are adequately repaired. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
L	Heavy vehicles must be clearly marked for visibility purposes. Travel at peak times and night should be avoided as far as is reasonably possible. These precautions should be written into the contracts of all service providers, and they should be fined if they do not adhere to the requirements.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department (weekly) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit the potential for road accidents.	(Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
M	Vehicles shall be maintained in good working condition to prevent breakdowns which may result in spillages and disruption of traffic in adjacent road networks and internal roads.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department (weekly) Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Visual observation of plant and vehicles for compliance with EMPR requirements.	(Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
N	Construction shall be limited to normal daylight working hours, in order to limit disturbance from vehicles and construction activity.	Construction	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent	Visual observation of working hours.	(Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)

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					Environmental Auditor (Annual)		
O	All construction and mining vehicles using public roads shall be in a roadworthy condition and their loads secured. They must adhere to the speed limits and all local, provincial and national regulations with regards to road safety and transport.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department (weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Visual inspection of vehicles for compliance with EMPR requirements.	(Vehicle inspection records) (ECO Monthly Report) (Annual Performance Assessment Reports)
P	Proper signage must be present in the vicinity of the site to prevent accidents. Adequate and appropriate traffic warning signage and appropriate speed limits for mine and construction vehicles should be implemented and adhered to.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department (weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Adequate traffic signage to prevent accidents.	(ECO Monthly Report) (Annual Performance Assessment Reports)
Q	Speed humps may be constructed where appropriate to avoid speeding. Experienced drivers should be hired to drive construction vehicles in order to prevent disruption of traffic on adjacent road network and internal roads. Driver competency to be audited by HSE department.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department (weekly)	No speeding or road accidents	Visual observation that vehicles are not speeding. (HSE inspection reports) (Incident registers)
R	It is recommended that the Mine become a member of the local security forum and establish radio-contact with surrounding properties.	Planning & design Construction Operation Decommission Closure & rehab	Before any activities start on site and continue for the life of the mine	Applicant Security forum	Safety officer CLO As required	Ensure better safety for applicant and local communities	Membership of security forum Staff supplied with two-way radios in all vehicles and offices (ECO Monthly Report) (Annual Performance Assessment Reports)
11. Hazardous Substance Management							
A	All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Appropriate hazardous storage to reduce potential for pollution of environment.	Visual observation that hazardous substance storage complies with EMPR requirements and relevant norms and standards. (Mine EO Weekly Report)

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	be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill.						(ECO Monthly Report) (Annual Performance Assessment Reports)
B	Hazardous substances shall be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. Hazardous storage areas shall be bunded (impermeable) with adequate containment (at least 110% the largest volume stored) for potential spills or leaks. Bunded storage areas shall be either be provided with an oil separator or sump. Waste from spillages will then be removed and recycled or disposed of responsibly.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Adequate provision for spill prevention and containment	Visual observation that storage facilities comply with EMPR requirements and relevant norms and standards. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
C	All fuel storage areas shall be bunded to contain at least 110 % of the volume stored and will comply with the relevant environmental and safety regulations. Fuel storage areas must be provided with an impervious surface with the provision to contain any potential fuel spillages during refuelling (e.g. a sealed concrete slab which drains to a sump/oil separator). The applicant and Contractor(s) must ensure that employees and labourers do not smoke or take part in any activity that may results in sparks in the vicinity of fuels and other flammable substances to prevent ignition.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Appropriate fuel storage to reduce potential for pollution of environment	Visual observation that fuel storage complies with EMPR requirements and relevant norms and standards. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
D	Refuelling may only take place within a dedicated area inside the mine that is subject to appropriate spill prevention and containment measures Refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental	Pollution prevention during refuelling	Visual observation that use of spill prevention measures such as drip trays is adequate. (Mine EO Weekly Report) (ECO Monthly Report)

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	to minimise the potential for leakage and to prevent spillage onto the soil. Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages shall be contained and cleaned up promptly.				Auditor (Annual)		(Annual Performance Assessment Reports)
E	Any containers in which hazardous substances (e.g. fuel, paints, solvents) are stored shall be clearly marked as to the contents therein (in accordance with OHSA regulations).	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Clear identification of hazardous substances to ensure correct fire prevention and spill response measures can be applied in the event of a spillage	Prevent accidental ingestion of hazardous substances/Visual observation that storage containers are adequately marked. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
F	All relevant national, regional and local legislation and relevant norms and standards with regard to the transport, use and disposal of hazardous materials shall be strictly complied with.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Compliance with relevant legislation, regulations, norms and standards.	(Legal register) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
G	Any excess or waste material or chemicals should be removed from the site and should preferably be recycled (e.g. oil and other hydrocarbon waste products). Any waste materials or chemicals that cannot be recycled shall be disposed of at a suitably licensed waste facility.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Responsible management of hazardous substances to prevent pollution of the environment. Waste minimisation	Visual observation that wastes are managed appropriately. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
H	Hazardous waste may only be disposed of at a licensed hazardous waste disposal facility. A specialist waste contractor shall dispose of such waste and shall be required to provide waste manifests and safe disposal certificates. The ‘cradle-to-grave’	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Appropriate disposal of hazardous waste	Environmental audits of waste register and manifests to ensure cradle-to-grave principle has been complied with. (Waste register/Waste manifests)

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	principle must be complied with.						(Safe disposal certificates) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
I	The Contractor shall ensure that all relevant personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances. If required, advice shall be obtained from the manufacturer with regard to the safe handling and storage of hazardous materials.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Adequate training to ensure proper use, handling and disposal of hazardous substances/	Visual observation that hazardous substance management complies with EMP requirements. (Environmental training records) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
J	The contractor shall supply the Mine EO with a list of all hazardous materials that would be present on site during the construction period. The same applies to any sub-contractor that should provide the contractor with this information. The Mine EO shall develop and maintain a hazardous substance register for all hazardous materials that shall be kept on site during all phases of the project. The register shall be provided to the ECO upon request. Material Safety Data Sheets (MSDS) must be available on site at the point of use and readily accessible for all hazardous substances stored.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Documentation available on site relating to correct use, handling, storage and disposal of hazardous substances	Audits to confirm that MSDS records are adequate and sufficient training has been conducted. (Hazardous substance register) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
K	Storage areas must be kept as dry as is practically possible and all storm and rain water collected in storage areas must be removed and disposed of in the PCD's.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Reduce potential for pollution of water resources/	Visual observation that appropriate mitigation measures are implemented. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)

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Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
12. Pollution Prevention							
A	Plant and equipment used during construction and mining must be adequately maintained so that during operations it does not spill oil, diesel, fuel, or hydraulic fluid. All plant and equipment must be inspected regularly (daily) to ensure that it is in good working condition, clean, and free from leaks of oil, petrol, diesel, hydraulic fluid and contaminating compounds.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit leaks and spills that can pollute the environment	Visual inspection of plant and equipment that it complies with EMP requirements. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
B	Any equipment that may leak, and does not have to be transported regularly, shall be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays shall be of a size that the equipment can be placed inside it. Daily inspections shall be carried out to ensure such spill prevention measures are in place and remain effective. Drip trays shall be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Adequate spill prevention measures to avoid pollution of the environment	Visual observation that drips trays are present and utilised. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
C	During construction, appropriate measures must be implemented to ensure that rainwater does not run into areas containing cement, oil, diesel etc. as this could result in a pollution threat. Storage areas for these substances should be placed on high-lying ground, and surrounded by erosion control measures e.g. rows of filled onion bags, silt fences etc. During operation, the storm water management system shall ensure that water from dirty areas reports to the PCD's.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent polluted runoff contaminating environment	Visual observation that hazardous materials storage does not result in polluted runoff. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
D	Servicing and maintenance of vehicles	Construction	Ongoing	Applicant	Contractors EO	Limit leaks and spills that	Visual observation that

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	may only take place in the workshop area (subject to suitable spill prevention and containment measures). If emergency repairs are required elsewhere on site, this shall be undertaken with the necessary spill prevention measures in place, as directed by the Mine EO.	Operation		Contractor	(Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	can pollute the environment	appropriate measures are in place during emergency repairs. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
E	Runoff from the site must be free of oil and solid waste and litter before joining the stormwater system. This will be ensured by securing any hazardous substances, in order that it does not enter runoff, and by cleaning up any refuse and construction material from the site.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of the environment from contaminated runoff	Visual observation that runoff into the stormwater system is not polluted. Water quality results if required. GN704 audits (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
13. Concrete/Cement Mixing and Batching							
A	Cement and liquid concrete are hazardous to the natural environment on account of the very high pH of the material, and the chemicals contained therein. As a result the contractor shall ensure that: • Concrete shall only be mixed on mortar boards, and not directly on the ground, • The visible remains of concrete, either solid, or from washings, shall be physically removed immediately and disposed of as waste, (Washing of visible signs into the ground is not acceptable). • All excess aggregate shall also be removed.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of soil or water resources	Visual observation that batching areas comply with EMP provisions. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
B	Batching of concrete and mixing of other construction materials must be conducted in an environmentally	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	Prevent pollution of soil or water resources	Visual observation that mixing of concrete and other construction

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	sensitive manner and all mixing of these materials must be done within bunded areas or on top of impervious liner materials (e.g. batching boards) so as to prevent pollution of the ground and/or water.				ECO (Monthly) Independent Environmental Auditor (Annual)		materials complies with EMPR requirements and relevant norms and standards. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
C	The Mine should try to make use of ready mix concrete instead of batching concrete on the premises. However, if a batching plant is necessary, run-off should be managed effectively to avoid contamination of any adjacent areas and the plant must be contained within a bunded area.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of soil or water resources	Visual observation concrete mixing and washing of plant and equipment complies with the EMP requirements. (Mine EO Weekly Report) (ECO Monthly Report)
D	Trucks delivering concrete shall not be washed on the site (including washing out the chute). Concrete trucks must be washed off site at a dedicated and approved area for such activity. In the event that no suitable washing area exists off-site, the mine may investigate the use of a dedicated washing area on site. The Mine EO shall be required to approve the design and location of the washing area prior to its use.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of soil or water resources	Visual observation that concrete washing takes place on site. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
E	Water from washing mixing equipment (mixers, tools and the like) shall not be discharged overland. The washing of equipment shall be done in a demarcated area which has provision for spill prevention. Such water shall be collected, and removed from the site and disposed of appropriately. During operation such water may be disposed of in the PCD's.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of soil or water resources	Visual observation that equipment is washed within dedicated area and pollution is prevented. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
14. Waste Management							
A	The Applicant shall develop and	Planning	Prior to	Applicant	ECO (Once-off)	Effective waste	Clean and tidy site

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	implement a waste management plan for the Mine which complies with the principles of the NEMWA and provides a mechanism for the effective management of waste throughout the LOM. This plan shall ensure the appropriate management of all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste etc.		construction		Independent Environmental Auditor (Once-off)	management and compliance with regulatory requirements.	No Litter onsite Waste Management Area compliant with regulatory requirements and environmental management principles. (Waste register) (Waste disposal records) (Safe disposal certificates) (ECO Monthly Report) (Annual Performance Assessment Reports)
B	The Applicant and Contractor(s) shall comply with the environmental management principles referenced in the NEMA (see EMPR Section 13). In respect of waste management, the 'cradle-to-grave' principle in particular must be adhered to so as to ensure accountability for correct waste handling, storage and disposal.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Accountability for waste management	Paperwork audits to verify compliance with cradle-to-grave principle. (Waste register) (Waste disposal records) (Safe disposal certificates) (ECO Monthly Report) (Annual Performance Assessment Reports)
C	The waste management system shall provide for adequate waste storage (in the form of waste skips and bins with lids), waste separation for recycling, and frequent removal of non-recyclable waste for permanent disposal at an appropriately licensed waste disposal facility. No waste material is to be disposed of on site. Under no circumstances may there be any burial of waste underground or on the site.	Planning Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure waste is adequately controlled in a responsible manner	Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Waste register) (Waste disposal records) (Safe disposal certificates) (Contractor EO daily checklist) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
D	Waste shall be separated into reusable, recyclable and non-recyclable waste, and shall be further separated as follows:	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	Ensure proper categorisation of waste to ensure correct handling and disposal	Visual observation that waste categorisation and separation complies with EMP requirements.

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	• Hazardous waste, consisting of substances that may be harmful to the receiving environment, and therefore require precautionary measures when handled. Examples include (but not limited to) oil, paint, diesel. • General waste, consisting of non-hazardous substances and substances that cannot be recycled. Examples include (but not limited to) construction rubble, excess construction materials that cannot be reused. • Recyclable waste, (where volumes are sufficient to make recycling feasible) shall preferably be deposited in separate bins. Recyclable material includes paper, tins and glass.				ECO (Monthly) Independent Environmental Auditor (Annual)		(Contractor EO daily checklist) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
E	A waste management area shall be provided on the site which shall be provided with a hard stand (concrete slab) on which waste skips will be placed. Waste skips must be marked for each of the relevant waste streams (hazardous waste, general waste, scrap metal, wood, rubble etc). The skips must be covered with tarps when not in use to prevent the ingress of water and waste being blown by the wind. Skips utilised for inert waste streams such as concrete rubble or wood do not need to be covered with tarps.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Effective waste management and compliance with regulatory requirements.	Clean and tidy site No Litter onsite Waste Management Area compliant with regulatory requirements and environmental management principles. (Waste register) (Waste disposal records) (Safe disposal certificates) (ECO Monthly Report) (Annual Performance Assessment Reports)
F	The Mine shall implement a waste removal regime that ensures waste skips do not exceed their capacity before being removed from site for disposal.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental	Ensure waste is removed from site on a regular basis to prevent potential for contamination of the environment.	Skips never exceed capacity. (Contractor EO daily checklist) (Mine EO Weekly Report) (ECO Monthly Report)

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					Auditor (Annual)		(Annual Performance Assessment Reports)
G	Environmental awareness training given to workers on site shall include appropriate waste management practices to be implemented on site.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure adequate awareness is created amongst workforce to ensure adequate implementation of waste management system.	(Training records) (ECO Monthly Report) (Annual Performance Assessment Reports)
H	Particular caution is to be exercised with regards to handling of hazardous waste, to ensure that it does not spill or leak from the waste collection containers. Refuse must also be protected from rain, which may cause pollutants to leach out.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure waste is adequately controlled in a responsible manner	Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Contractor EO daily checklist) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
I	The total volume of general waste stored shall not exceed 100m^3. In the case that a storage capacity exceeding this amount is required or planned for, the necessary waste permits must be obtained in accordance with the NEMWA beforehand (GN718).	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Appropriate waste storage to reduce potential for pollution of environment	Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
J	Littering shall be strictly prohibited. The site shall remain in a neat and tidy condition at all times. If required, the mine shall make use of regular litter patrols to remove litter and ensure the site remains clean, neat and tidy.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent contamination of environment from litter	Visual observation that site is free of litter (Contractor EO daily checklist) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
K	The mine shall maintain a waste register which shall be used to track all	Planning	Ongoing	Applicant	Contractors EO (Daily)	Responsible management of waste in compliance	Audits to verify compliance.

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	waste removed from site. Proof of appropriate waste disposal shall be kept on file at the site for auditing purposes.	Construction Operation Decommissioning Rehab and Closure		Contractor	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	with cradle to grave principle	(Waste register) (Waste disposal records) (Safe disposal certificates) (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in the prescribed and correct manner.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Protection of soil resources.	Visual observation that soil management guide is being adhered to. (Mine EO Weekly Report) (ECO Monthly Report) (Annual Performance Assessment Reports)
15. Sewage and Sanitation							
A	There must be adequate provision for safe and effective sanitation (i.e. ablution facilities) at the site and these shall conform to all relevant health and safety standards and codes. The Mine shall ensure compliance with the OHSA and MHSA in terms of sewage and sanitation (managed by safety department). Under no circumstances will pit latrines, french drain systems or soak away systems be allowed.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Safety Department ECO (Monthly) Independent Environmental Auditor (Annual)	Safe and effective sanitation that complies with legal provisions of OHSA, MHSA and regulations	Visual observation that EMP and legal requirements relating to sewage and sanitation are met. (Safety audit reports) (ECO Monthly Report) (Annual Performance Assessment Reports)
B	Toilets must be easily accessible. Toilets shall be placed outside areas susceptible to potential flooding and shall not be placed within 50m of any wetland or watercourse. Ablution facilities shall be located a sufficient distance from any offices or eating areas to prevent nuisance from offensive odours. Sanitary arrangements shall also be to the satisfaction of the ECO.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Safety Department ECO (Monthly) Independent Environmental Auditor (Annual)	Safe and effective sanitation that complies with legal provisions of OHSA and regulations	Visual observation that EMP and legal requirements relating to sewage and sanitation are met. (Safety audit reports) (ECO Monthly Report) (Annual Performance Assessment Reports)
C	In the case of chemical toilets, there must be a minimum of one chemical toilet provided per 15 persons. The	Construction Operation	Ongoing	Applicant Contractor	Safety Department ECO (Monthly)	Safe and effective sanitation that complies with legal provisions of	Visual observation that EMP and legal requirements relating to

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	toilets shall be of a neat construction and shall be provided with doors and locks and shall be secured to prevent them from falling over. Toilet paper dispensers shall be provided in all toilets and toilet paper shall be supplied at all times.	Decommissioning			Independent Environmental Auditor (Annual)	OHSA and regulations	sewage and sanitation are met. (Safety audit reports) (ECO Monthly Report) (Annual Performance Assessment Reports)
D	The Contractor (or reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. Chemical toilets shall be emptied/serviced frequently to avoid offensive odours (at least weekly). Toilets must be kept in a clean, neat and hygienic condition. Chemical toilets shall be cleaned and emptied before the contractor's long weekends or public holidays.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Safety Department ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure clean and sanitary conditions and prevent nuisance from offensive odours	Visual observation that ablution facility location and servicing complies with EMP requirements. (Safety audit reports) (ECO Monthly Report) (Annual Performance Assessment Reports)
E	All reasonable measures shall be taken to ensure that no spillage occurs when chemical toilets are cleaned and emptied. Any accidental spillage must be reported to the Mine EO and cleaned up immediately.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of environment	Visual observation that there are no spillages from cleaning of chemical toilets. (Safety audit reports) (ECO Monthly Report) (Annual Performance Assessment Reports)
F	Disposal of sewage from chemical toilets shall be in a safe and responsible manner and at an approved facility specifically for that purpose. Proof of sewage removal and disposal shall be kept on file for auditing purposes.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Safety Department ECO (Monthly) Independent Environmental Auditor (Annual)	Responsible disposal of sewage	Visual observation that there are no spillages from cleaning of chemical toilets. (Safety audit reports) (ECO Monthly Report) (Annual Performance Assessment Reports)
16. Pre-construction Surveys							
A	Do a crack survey at the houses of directly affected neighbours and determine if houses will be able to withstand blasting in the case of	Planning & design	Before activities on site commence	Applicant	CLO to share with landowners and ensures applicant and land owner	Protect interest of applicant and land owner in event of future claims. Ensure safety of residents	Crack survey Reinforced houses (ECO Monthly Checklist/Report)

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	traditional houses. If houses cannot withstand blasting applicant must assist residents with enforcing their houses.				both have a copy. Safety officer or blasting specialist to inspect houses to see if it has been reinforced adequately.	living in traditional structures within area affected by blasting.	(Annual Performance Assessment Reports)
B	Conduct a pre-construction survey of the site prior to construction including a detailed photographic record of the site and surrounding sensitive receptors.	Planning	Once-off	Applicant	ECO (Once-off) Independent Environmental Auditor (Once-off)	Photographic record of site prior to disturbance	(Annual Performance Assessment Reports)
17. Construction and Site Camps							
A	Construction camps, site camps, offices, workshops, and any other facilities required on the site for construction shall be situated in a manner that minimises any potential negative impacts on the environment. The site selection shall be undertaken in consultation with the Mine Manager and ECO, and shall be located as far as is practicable, outside flood lines, and above the 1 in 50 flood level mark within the boundaries of the mining area. No construction camp or office site shall be located closer than 100 metres from a stream, river, spring, dam or pan. Any temporary structures erected during construction will be restricted to the construction camp site.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit construction footprint and minimise excessive environmental disturbance to the environment and potential for pollution	Visual observation that construction camp complies with EMPR conditions. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	No construction or mine worker shall be allowed to stay on the neighbouring sites, unless it is cleared with the neighbouring owner. In such an event all requirements for the contractor's camp will apply.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit construction footprint and minimise excessive environmental disturbance to the Environment and potential for pollution	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The physical footprint of any	Construction	Ongoing	Applicant	Contractors EO	Limit construction footprint	(ECO Monthly

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	construction or site camp shall be minimised and vegetation clearance should be kept to the minimum required area. Topsoil shall be handled in accordance with the soil management principles presented in this EMPR and the soil management guide developed for the Mine.	Operation		Contractor	(Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	and minimise excessive environmental disturbance	Checklist/Report) (Annual Performance Assessment Reports)
D	All construction and/or site camps shall be enclosed with a fence. The mesh size should be small enough for the fence to act as a catch net for blown debris and as a demarcation of the site. The fence shall be maintained as required to ensure access control remains effective. All temporary fences erected by the contractor shall be removed and the site restored on completion of construction, unless otherwise agreed in writing with the Applicant.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Visual observation that fences are maintained and comply with EMPR provisions.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Site and construction camps must be kept in a clean, neat and tidy condition at all times. The contractor shall maintain good housekeeping practises and shall comply with the relevant HSE regulations in terms of materials storage. Stockpiles of construction materials may only be placed within demarcated areas within the construction camp. Laydown areas must be kept neat and tidy and free of litter or waste at all times.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of the environment.	Visual observation that litter control and housekeeping materials comply with EMPR requirements and construction regulations. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	A waste storage area must be established within the site camp/construction camp that provides for appropriate and adequate waste storage and waste separation for recycling. All waste must be adequately contained so as to prevent ground and/or water pollution. The	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Appropriate waste storage to reduce potential for pollution of environment.	Visual observation that waste management complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly

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	total volume of general waste stored shall not exceed 100m^3. In the case that a storage capacity exceeding this amount is required or planned for, the necessary waste permits must be obtained in accordance with the NEMWA beforehand (GN718).						Checklist/Report) (Annual Performance Assessment Reports)
G	The site camp/construction camp shall have adequate provision for the storage of hazardous waste (e.g. old oil filters, soil from spills etc.) and the waste shall be contained within closed containers to prevent the possibility of spillages.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Appropriate hazardous waste storage to reduce potential for pollution of environment.	Visual observation that waste management complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	All fuel storage areas shall be bunded to contain at least 110 % of the volume stored and will comply with the relevant safety regulations. Fuel storage areas may not be located within 100m of the watercourse and the total volume of fuel stored on site may not exceed 30 cubic metres (30 000l) without the necessary authorisation in terms of the NEMA. Fuel storage areas must be provided with an impervious surface with the provision to contain any potential fuel spillages during refuelling (e.g. a bunded, sealed concrete slab which drains to a sump/oil separator). No person smoke or take part in any activity that may results in sparks in the vicinity of fuels and other flammable substances to prevent ignition.	Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Appropriate fuel storage to reduce potential for pollution of environment.	Visual observation that fuel storage complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	All hazardous substances shall be stored within designated areas that	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily)	Appropriate hazardous storage to reduce potential	Visual observation that hazardous substance

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	comply with the relevant HSE standards (e.g. access control, HSE signage, fire fighting equipment etc.) and that provide for spill prevention and containment. It is recommended that a dedicated, bunded and fenced Hazardous Storage Area is provided within the construction camp for this purpose.	Decommissioning Rehab and Closure			Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	for pollution of environment.	storage complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Site camps/construction camps shall be provided with portable fire extinguishing equipment, in accordance with all relevant legislation and this equipment must be readily accessible.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Adequate fire prevention measures.	Visual observation that fire fighting equipment is readily available and maintained to standard. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
K	Batching of concrete and mixing of other construction materials must be conducted in an environmentally responsible manner and all mixing of these materials must be done within bunded areas or on top of impervious liner materials (e.g. batching boards) so as to prevent pollution of the ground and/or water. If a batching plant is necessary, run-off should be managed effectively to avoid contamination of any adjacent areas and must be contained within a bunded area.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of soil and water resources.	Visual observation that mixing of concrete and other construction materials complies with EMPR requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
L	There may be no uncontrolled discharge of polluted water from the site camp/construction camp. Plant and equipment washing areas must be situated away from watercourses and areas of shallow ground water, and the use of biodegradable soaps is recommended. All effluent water from	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent pollution of water resources.	Visual observation that no polluted water is discharged into environment. (Water quality monitoring data and reports) (Mine EO weekly

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Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	the camp / office sites shall be disposed of in a properly designed and constructed system, designed to avoid erosion and situated so as not to adversely affect any water sources. Only domestic type wastewater shall be allowed to enter this system and any discharge into the environment shall comply with the applicable DWAF standards. As a general rule, the "General Limit" as presented in the DWAF Water Quality Standards and Guidelines shall apply unless otherwise directed by the ECO or authorities.						checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
M	The Contractor(s) shall designate restricted eating areas for eating during normal working hours. There shall be adequate provision of refuse bins near to eating areas that must be cleaned on a daily basis. The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly Independent Environmental Auditor (Annual))	Avoid pollution of environment and provide hygienic and uncontaminated conditions to prevent illness.	Visual observations that eating areas comply with EMPR requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
N	No open fires shall be permitted within the site camp/construction camp, except where approved by the responsible safety officer and ECO and within a designated structure designed for that purpose. In such cases fire fighting equipment must be readily available in the vicinity of the fire place and an appropriate safety representative should be present at all times during burning of the fire. All fires shall be fully extinguished after use.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent veld fires and damage to environment or harm to people and animals.	Visual observation for compliance with EMPR condition. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
18. Decommissioning							
A	All infrastructure, equipment, plant, temporary housing and other items used during the mining period will be	Decommissioning	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure all plant and infrastructure are removed from site to allow	Visual observation that decommissioning complies with EMP and legal

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	removed from the site (section 44 of the MPRDA). Infrastructure should be removed down to foundations to prevent loss of soil productivity.				Independent Environmental Auditor (Annual)	successful rehabilitation of the site	requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	All vehicles, equipment and other assets belonging to the Applicant/Contractor(s) must be removed from the property upon completion of the mining operation, including any excess aggregate, gravel, stone, concrete, temporary fencing and the like.	Decommissioning	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure all plant and infrastructure are removed from site to allow successful rehabilitation of the site	Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	No discard materials of whatsoever nature shall be buried on the site, or on any vacant or open land in the area. Waste material of any description, including receptacles, scrap, rubble and tyres, will be removed entirely from the mining area and disposed of at a recognised landfill facility. It will not be permitted to be buried or burned on the site.	Decommissioning	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure all plant and infrastructure are removed from site to allow successful rehabilitation of the site	Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	During decommissioning, all boreholes which will not be required for later monitoring or other useful purposes should be grouted to prevent possible cross flow and contamination between aquifers.	Decommissioning Decommissioning	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure all plant and infrastructure are removed from site to allow successful rehabilitation of the site	Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	In the event that the landowner requests the retention and use of any	Decommissioning	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure all plant and infrastructure are removed	Visual observation that decommissioning complies

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	boreholes, the Department of Water Affairs must be consulted with regards to the necessary legal requirements (e.g. water use licences and/or borehole registration).				Independent Environmental Auditor (Annual)	from site to allow successful rehabilitation of the site	with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
19. Rehabilitation							
A	An Integrated Rehabilitation and Closure Plan shall be developed by the Applicant prior to the onset of construction. The Plan must be viewed as a dynamic document and shall be subjected to independent review on an annual basis (together with the quantum for financial provision). As a minimum the Integrated Rehabilitation and Closure Plan shall include the following; • Desired end land use objectives, • Methodology and proposed schedule for progressive rehabilitation to be undertaken concurrently with mining operations, • Details of soil preparation procedures including proposed measures to improve soil fertility (if so required) and the sustainability thereof, • A list of the plant species that will be used in the rehabilitation process. Only indigenous species may be utilised and these species should be representative of the relevant vegetation unit/landscape type of the area, • Procedures for ensuring vegetation growth and survival (watering,	Planning Construction Operation Decommissioning Rehab and Closure	Developed prior to construction and implemented throughout lifespan of project	Applicant	ECO (Once-Off) prior to construction Independent Environmental Auditor (Annual)	Ensure adequate planning and provision for effective rehabilitation even in the event of or premature or unforeseen closure.	Annual Independent review of Integrated Rehabilitation and Closure Plan and quantum for financial provision. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	fertilisation etc.), • Details of proposed storm water and erosion control measures to ensure re-vegetation is successful and not hampered by scouring and erosion, • Monitoring procedures that will be implemented to assess re-vegetation efforts (duration and frequency of monitoring, criteria for determining success of rehabilitation), • Procedures for preventing the establishment of alien invasive vegetation in rehabilitated areas.						
B	Upon completion if the mining operation and closure of the facility, the Applicant shall ensure that all cleared and/or disturbed areas (as a result of the activity) within and outside the boundaries of the site shall be rehabilitated in accordance with the Integrated Rehabilitation and Closure Plan.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure disturbed areas are rehabilitated	Visual observation that rehabilitation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The ECO will specify where ripping and/or scarifying is necessary to remediate compacted areas. Before topsoil is spread, the compacted area will be deep-ripped to a depth of at least 30 cm where soil depth permits.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)		Visual observation that rehabilitation is undertaken in accordance with EMPR requirements. (EMPR checklist) (Annual Performance Assessment Reports)
D	Rehabilitation will include returning the slope to the minimum possible gradient (preferably less than 1:3), the topsoil will be replaced for vegetation re-establishment and contour drains will be built to prevent erosion if necessary.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No steep slopes that may result in instability and erosion	Visual observation that slopes are reduced to minimum possible gradient. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
							Assessment Reports)
E	The area must be rehabilitated using indigenous vegetation from the area in such a way that it will return as close as possible to the original production potential. Rehabilitation shall be overseen by a suitably qualified specialist who shall approve the indigenous seed mix to be used. The rehabilitated area must be returned to a self sustaining ecosystem that is consistent with the original vegetation type.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Rehabilitation to return area to self sustaining ecosystem	Confirmation that rehabilitation has been successful and shall remain self sustaining. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	The use of inorganic fertiliser to improve the success of re-vegetation should only be undertaken with caution and should be considered in consultation with a suitably qualified specialist. It must be born in mind that fertilisation with inorganic fertilisers is more of a short term solution. Long term sustainability will only be achieved with adequate soil improvement in terms of soil structure, Soil Organic Matter (SOM) and soil biota. Soil improvement measures will increase the speed at which the vegetation in the rehabilitated areas will establish and return to a self—sustaining ecosystem. Measures which must be investigated and implemented where appropriate shall include, but not be limited to, • Improving the soil organic matter (SOM) content of the topsoil to improve soil structure, aeration and ensure long term sustainability through the addition of manure, compost, mulch etc. (not alien plant matter to be used); and	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Appropriate soil improvement to ensure sustainable soil fertility and ecosystem functioning	Confirmation that appropriate soil improvement has been undertaken. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	• Improving the quantity and diversity of soil biota through inoculation with appropriate Mycorrhizae and other soil biota.						
G	The post mining environment should be planned with specific land uses in mind which would prevent the additional transformation of natural areas in the landscape. Local landscape features such as rocky outcrops and wetlands should be re-constructed in areas which would facilitate the movement of fauna in the area. Trained zoologists/ecologists should advise on the recreation of destroyed landscape features in order to optimize rehabilitation.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)		Avoid and prevent loss of habitat and biodiversity (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	Any access road or portions thereof, constructed by the Applicant which will no longer be required by the landowner/tenant, shall be removed and/or rehabilitated to the satisfaction of the ECO and Regional Manager (DMR).	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Rehabilitation of disturbed areas	Visual observation that rehabilitation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	Any gate or fence erected by the Applicant which is not required by the landowner/tenant, shall be removed and the situation restored to the pre mining situation.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Rehabilitation of disturbed areas/ (ECO Monthly Checklist/Report)	Visual observation that rehabilitation measures have been complied with. (Mine EO weekly checklist) (Annual Performance Assessment Reports)
J	Erosion control measures shall be implemented where necessary (such as berms, brushpacking, silt fences etc.). Erosion control and silt prevention measures shall be inspected regularly and shall be maintained whenever required to	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent erosion during and after rehabilitation	Visual observation that rehabilitation is undertaken in accordance with EMP requirements. (Mine EO weekly checklist) (ECO Monthly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	ensure they remain effective.						Checklist/Report) (Annual Performance Assessment Reports)
K	No alien or invader plant species should be introduced on site during rehabilitation. The weed management plan shall be implemented throughout the rehabilitation and closure phase. Regular monitoring of the rehabilitated area shall be undertaken and all alien vegetation shall be eradicated and/or controlled prior to it setting seed. Weed management shall be to satisfaction of the ECO and Regional Manager (DMR). Where required, the necessary adjustments should be made to ensure the complete re-establishment of the natural vegetation.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Establishment of natural vegetation. No invasive or alien vegetation	Visual observation that weeds are eradicated/controlled. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
L	Regular monitoring of the success of rehabilitation measures will be implemented by a suitably qualified independent party for a period of at least ten (10) years following cessation of mining activities.	Rehab and Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure adequate rehabilitation	Confirmation that rehabilitation has been successful and natural vegetation has been re-established. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
M	The adit must be sealed once mining activities have ceased as per the rehabilitation plan.	Rehab and Closure	Upon completion of decommissioning	Applicant	ECO (Once-Off) Independent Environmental Auditor (Once-off)	Ensure adequate prevention of water pollution.	Annual Independent review of efficacy of seal. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
N	Grouting of lowest points of underground mining areas and the pillars of material not removed during the mining operations as per the	Operation	Ongoing through operation	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental	Ensure prevention of water pollution.	Confirmation of efficacy of pollution prevention measure. (Mine EO weekly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	rehabilitation plan.				Auditor (Annual)		checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
20. Mine Closure							
A	Should the activity ever cease or become redundant the applicant shall undertake the required closure process in accordance with Section 43 of the MPRDA.	Rehab and Closure	Upon Closure	Applicant	Independent Environmental Auditor (Annual)	Ensure proper closure process is followed	Visual observation that rehabilitation is undertaken in accordance with EMP and legal requirements. (Final performance assessment, environmental risk assessment and Closure Plan).
21. Post-Closure Monitoring							
A	The post-closure monitoring and management period will be implemented by a suitable qualified independent party for a minimum of ten (10) years following cessation of mining activities. The monitoring activities during this period will include but not be limited to: • Bodiversity monitoring; • Ground and surface water; • Air quality monitoring; • Bio-monitoring; • Re-vegetation of disturbed areas where required; • Weltands; and • Maintenance on installed access control or fencing. Provision must be made to monitor any unforeseen impact that may arise as a result of the proposed mining activities and incorporated into post closure monitoring and management.	Rehab and Closure	Post-closure	Applicant	Independent Environmental Auditor (Annual) (Annually)	Ensure proper rehabilitation is accomplished	Visual confirmation that rehabilitation is undertaken in accordance with EMP and legal requirements. (Annual performance assessment, environmental risk assessment).

21.2 CULTURAL AND HERITAGE RESOURCES

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Planning	N/A	N/A	N/A	N/A	N/A
Construction	Identification of heritage features Demarcation of heritage features Relocation of heritage features as necessary Preparation of footprint area Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of external haul roads (GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11)	Impact on palaeontology	-16	-9	-13.5
		Impact on stillborn graves	-9	-3.25	-5.42
Operation	Vegetation clearance Removal of infrastructure Planned placement of infrastructure Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of infrastructure and services Drilling Blasting Excavations Establishment of internal haul roads (GNR 544 Activity 22) Establishment of RoM stockpiles	Impact on palaeontology	-16	-9	-13.5
		Impact on stillborn graves	-9	-3.25	-5.42

	Waste rock dumps for backfilling Soil management Concurrent rehabilitation				
Decommissioning	N/A	N/A	N/A	N/A	N/A
Rehabilitation and Closure	N/A	N/A	N/A	N/A	N/A

HERITAGE MANAGEMENT STRATEGY

The strategy for managing heritage impacts is based on the following principles:

- First and foremost, to prevent any disturbance, damage or impact to any heritage features;
- Identification and protection of cultural heritage by ensuring that internationally recognized practices for the protection, field based study, and documentation of cultural heritage are implemented;
- The development of a chance find procedure for managing chance finds of cultural heritage;
- Where disturbance or damage to heritage features is unavoidable, the required action will be to obtain the necessary permits and have the sites fully documented by a relevant specialist prior to removal/destruction;
- The Appointment of external experts to assist in the assessment and protection of cultural heritage;
- Where graves must be relocated, the exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review
Planning	Appoint palaeontologist to assist in development of chance finds procedure	1 month prior to onset of construction	Annual internal review	Heritage specialist to be appointed	Environmental Manager (annual internal review) Heritage specialist (External review as required)
	Appoint archaeologist to assist in development of chance finds procedure.	1 month prior to onset of construction	Annual internal review	Heritage specialist to be appointed	Environmental Manager (annual internal review) Heritage specialist (External review as required)
	Develop Chance Finds Procedure that incorporates heritage and palaeontological features	1 month prior to onset of construction	Annual internal review	Heritage specialists to be appointed	Environmental Manager (annual internal review) Heritage specialist (External review as required)
	Develop Grave Relocation Procedure	Within 3 months of start of construction	Annual internal review	Heritage specialist to be appointed	Environmental Manager (annual internal review) Environmental Consultant (External review as required)
	Implement technical management measures as per EMP	Throughout planning	Environmental Officer (weekly)	Applicant Contractor	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Demarcation of red zone as	Two weeks before the	Once-off	Applicant	Mine EO (Weekly) ECO

	per HIA.	commencement of the construction phase.			(Monthly audit) Independent Environmental Auditor (Annual)
Construction	Monitor demarcated heritage areas	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant Contractor	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Monitor demarcated heritage areas	Throughout operation	Environmental Officer (weekly)	Applicant Contractor	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant Contractor	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant Contractor	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation and Closure	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
22. Heritage Features							
A	The Applicant must appoint suitably qualified palaeontology and	Planning Construction	During planning phase and	Applicant	ECO (Once-off)	Protection of heritage features	Mine EO (Weekly) ECO

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	archaeology specialists to develop a chance finds procedure. These specialists must train the ECO and Mine EO on what potential heritage features may be on site and the chance finds procedure. Should any potential heritage features be identified the relevant specialist must be contacted.	Operation	ongoing throughout operations				(Monthly audit) Independent Environmental Auditor (Annual)
B	Demarcation of red zone (as per the HIA) on mine plans as well as on the ground. This area must be considered a no-go area for earthworks, including any disturbance of the surface. Should any disturbance of this are be required the appointed archaeologist must be notified.	Planning	Priority action to follow on appointment of archaeologist. Must be undertaken well in advance of construction	Applicant	ECO (Monthly)	To ensure that the red zone is mitigated in the correct manner.	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
C	The construction activities will be limited to the designated areas.	Construction	Ongoing	Contractor	EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Protection of Heritage resources.	Visual observation that no heritage sites have been unearthed or damaged. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	All identified gravesites will be fenced off, or relocated. Access to gravesites will be arranged for family members/friends of the deceased if requested. Grave sites that remain insitu shall be inspected on a regular basis to ensure no damage has occurred.	Planning	As required	Mine Manager	EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Protection of Heritage resources.	Visual observation that no heritage sites have been unearthed or damaged. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	In the event that graves or cemeteries must be relocated, a full grave relocation process must be undertaken that includes comprehensive social	Planning Construction Operation	As required	Applicant Contractor	ECO (Monthly) Independent Environmental Auditor (Annual)	Exhumation process that keeps the dignity of the remains and family intact and complies with legal	Verification that a proper relocation process is undertaken. (ECO Monthly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	consultation. The grave relocation process must include: • A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, which will be at least 60 days in length; • Site notices indicating the intent of the relocation • Newspaper Notice indicating the intent of the relocation • A permit from the local authority; • A permit from the Provincial Department of Health; • A permit from the South African Heritage Resources Agency, if the graves are older than 60 years, or unidentified and thus presumed older than 60 years; • An exhumation process that keeps the dignity of the remains and family intact; • The whole process must be done by a reputable company that is well versed in relocations; • The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.	Decommissioning Rehab and Closure				requirements.	Checklist/Report) (Annual Performance Assessment Reports)
F	A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction and mining employees.	Construction Operation	Ongoing	Applicant Contractor	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Awareness regarding cultural heritage and appropriate protective measures and procedures.	Verify that training has been conducted. (Training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
G	All buildings must be evaluated for the possible presence of infant burials through social consultation. A permit from the Provincial Heritage Resources Authority Mpumalanga would be required if heritage structures need to be demolished. The remains of the buildings should be mapped and documented by photographs and drawings.	Planning	Ongoing	Applicant Contractor	ECO (Monthly) Independent Environmental Auditor (Annual)	Compliance with relevant legal requirements and contribution to knowledge and research through documentation of findings by a specialist.	Verify that specialist has carried out appropriate procedure and permits are in place prior to demolition. (Destruction permits) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	If a possible heritage site is discovered during construction or mining activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Protection of Heritage resources.	Visual observation that no heritage sites have been unearthed or damaged. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
23. Archaeological Watching Brief							
A	The appointed archaeologist must be notified in writing of any planned excavation or disturbance to either a section or the entire red zone defined above. This written notification must be sent at least two weeks in advance of planned action.	Construction and Mining Phases	Two weeks ahead of planned action.	Applicant	ECO Applicant	To ensure that the appointed archaeoloigist is informed of any planned disturbance to the red zone.	(ECO Monthly Checklist/Report) Specialist Report
B	The appointed archaeologist must undertake an archaeological watching brief during the excavations or disturbances to the defined red zone. This watching brief will comprise a fieldwork team consisting of one archaeologist and one archaeological field assistant conducting intensive on-site walkthroughs and assessments throughout the excavation and disturbances.	Construction and Mining Phases	On pre-scheduled day(s) when the excavations and/or disturbances to the red zone will take place.	Applicant	Archaeologist ECO Applicant	To identify any evidence for human remains or graves.	(ECO Monthly Checklist/Report) Specialist Report

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
C	The appointed archaeologist must compile a watching brief report with photographs providing the findings of the watching brief.	Construction and Mining Phases	Two weeks after completion of watching brief.	Applicant Specialist	Archaeologist ECO Applicant	To provide written feedback on the watching brief.	(ECO Monthly Checklist/Report) Specialist Report
24. Mitigation Measures Required should Suspected Evidence for Human Remains or Graves be Identified during Watching Brief							
A	Should suspected evidence for graves or human remains be identified during the watching brief, the archaeologist must immediately inform the ECO who in turn must inform the Mine SHEQ Manager immediately.	Construction and Mining Phases	Immediately after discovery of suspected evidence of human remains or graves.	Applicant Specialist	Archaeologist ECO	To ensure that the ECO and Mine SHEQ Manager immediately becomes aware of the potential discovery of graves.	(ECO Monthly Checklist/Report) Specialist Report
B	The archaeologist, with assistance provided by the ECO and Mine SHEQ Manager, must demarcate an area around the suspected position of a grave that must be kept clear of any further disturbance, excavation or mining activities until such time that the archaeologist provides written permission for the demarcation to be lifted and the demarcated area to be impacted upon.	Construction and Mining Phases	Immediately after ECO and Mine SHEQ Manager are on site.	Applicant Specialist	Archaeologist ECO	To ensure that the suspected grave is not further damaged or destroyed until mitigation measures can be undertaken.	(ECO Monthly Checklist/Report) Specialist Report
C	The archaeologist will provide the ECO with the mitigation measures that will be required from this point onward. The exact mitigation measures to be followed would depend on the characteristics of the discovery and conditions of the site. These measures may include a rescue permit application to SAHRA, the physical excavation of the suspected grave, analysis of suspected human remains and if confirmed as human the curation of excavated human remains in a registered mortuary followed by a social consultation process. Once the social consultation process has been completed to the satisfaction of	Construction and Mining Phases	Immediately after demarcation of suspected human remains.	Specialist	Archaeologist ECO	To outline the exact mitigation measures required.	(ECO Monthly Checklist/Report) Specialist Report

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	SAHRA the remains can be reburied in a municipal cemetery.						
25. Palaeontology							
A	The Applicant shall assess the Heritage EIA report (see Appendix B) and implement the recommended measures relating specifically to Palaeontology where appropriate and feasible.	Planning Construction Operation Decommissioning Rehab and Closure	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Contribute to understanding and research of paleontological features.	Verification that excavations are monitored for signs of fossils and where these are found a specialist is afforded the opportunity to document the findings. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The appointed palaeontologist must conduct training with a dedicated member of the staff of the mining company as well as the ECO to do preliminary investigations of the shale beds on a continuous basis and report any finds to the ECO who will then inform the palaeontologist of the find and decide on possible site visits to inspect the finds.	Planning	To be undertaken well ahead of the start of the Construction Phase.	Appointed Palaeontologist ECO	ECO Applicant	To train a dedicated staff member in order to assist with the assessment of shale beds and report any finds to the ECO.	(ECO Monthly Checklist/Report)

21.3 SOCIO-ECONOMIC IMPACTS

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	**ACTIVITY**	**IMPACT**	**SIGNIFICANCE**		
			Pre-mitigation	**Post-mitigation**	**FINAL Significance**
Planning	Planning activities Stakeholder engagement	Public perceptions	13.75	10	11.67
		Public expectations	-15	-12	-18

	Community liaison	Social licence to operate	16.25	17.5	23.33
Construction	General construction activities that may lead to social impacts be it physical or perceived. Employment of local labour Stakeholder engagement Community liaison CSI initiatives Skills development programmes Environmental awareness training HIV/AIDS Awareness programmes	Health impacts	-23.75	-22.5	-45
		Social vices	-20	-15	-25
		Community tension and family impacts	-17.5	-12	-20
		Crime and violence	-17.5	-13	-21.67
		Conduct of contractors	-11	-10	-15
		Traffic from a safety and nuisance perspective	-11	-10	-16.67
		Dust from a nuisance and livelihood perspective	-15	-8.25	-13.75
		Sense of place	-16.25	-14	-23.33
		Economic impacts	21.25	22.5	33.75
		Impacts associated with a construction camp	-15	-11	-16.5
		Property values	-8.75	-8.75	-10.20
		GDP addition to the economy	-8.75	16.25	16.25
		Employment addition to economy	16.25	15	22.5
		Timber security	15	-5	-6.66
		Food security	-10	-1	-1
Operation	General Mining activities that may lead to social impacts be it physical or perceived (GNR 545 Activity 20) Integration with Municipalities' strategic long term planning. Employment of local labour Stakeholder engagement Community liaison CSI initiatives Skills development programmes Environmental awareness training HIV/AIDS Awareness programmes	Water from a livelihood perspective	-23.75	-18	-36
		Light pollution from a sense of place perspective	-10	-6.75	-7.87
		Dust from a nuisance perspective	-17.5	-13	-23.83
		Impacts associated with the transport of workers	-15	-12	-18
		Blasting and vibrations from a social perspective	-20	-15	-22.5
		Impact on social and physical infrastructure	-17.5	-13	-17.33
		Impact on community relations	-13	-13	-17.33
		Crime and violence	-14	-14	-23.33
		Economic impacts	21.25	22.5	37.5
		Relocation	-22.5	-21.25	-38.95
		Annual GDP	-1	17.5	26.25
		Employment addition to economy	17.5	16.25	24.37
		Tax and fiscal contribution	16.25	17.5	17.5
		Forex contribution	17.5	17.5	17.5

Decommissioning	Decommissioning activities Stakeholder engagement Community liaison	Loss of jobs and economic opportunities	-21.25	-17.5	-32.08
		Decrease in GDP	17.5	-17.5	32.08
Rehabilitation & Closure	Rehabilitation activities Stakeholder engagement Community liaison	Expectations	-13	-11	-18.33
		Re-Instatement of livelihoods	14	17	22.67

SOCIO-ECONOMIC MANAGEMENT STRATEGY

The social impacts will be managed according to the following principles:

- Reduce negative impacts on communities and individuals;
- Enhance positive impacts on communities and individuals;
- Gain and maintain social licence to operate;
- Establish and maintain good relationships with neighbours, local communities and other stakeholders;

The action plan for managing the social impacts will be incorporated in the following mechanisms:

- Management Plans;
  - Social Action Plan (monitoring of social mitigation and management measures)
    - Appoint community liaison officer
    - Health and Safety Program
    - Access protocol
    - In-house infectious diseases strategy
    - Basic clinic for employees
    - Workforce Code of Conduct
    - Drug and Alcohol management policy
    - Local employment strategy / recruitment policy
    - Crack survey
  - Social and Labour Plan
    - Housing Policy
    - Partnership with Non-Profit Organisation (NPO)
    - Procurement Policy and empowerment of local businesses
    - Skills Development Plan
  - Relocation action plan (if required);
  - Grievance mechanism;
  - Stakeholder engagement plan;
- Community Engagement Mechanisms;

- Community liaison forum (CLF)
- Environmental Forum

- Strategies;
  - Community relations strategy
  - Communication strategy
  - Pollution Fund

IMPLEMENTATION PLAN					
Phase	**Management Action**	**Timeframe for Implementation**	**Review/Repeat frequency**	**Responsible Party For Implementation**	**Responsible Party For Monitoring and Review**
Planning	Develop social action plan	As soon as project enters public domain	Once-off	Applicant	CLO Internal once appointed Social expert External but not legally required
	Appoint appropriately qualified CLO (social science qualification)	Before consultation with stakeholders start	Appointment for the life of the mine	Applicant	Not required apart from usual HR processes
	Implement Social and Labour Plan	Requirement for Mining Right	Annual	Applicant/HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Annual audit of SLP implementation	Annual	Annual	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Initiate Community Liaison Forum	As early in project planning phase as possible	Quarterly Meetings	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Develop and Implement Recruitment Policy	As early in project planning phase as possible	Prior to appointment of contractor	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Stakeholder and Community liaison	Throughout Planning phase	Ongoing	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit)

					Independent Environmental Auditor (Annual)
	Develop and implement Stakeholder Engagement Plan	As early in project planning phase as possible	Annual internal review	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Develop Grievance Mechanism	As early in project planning phase as possible	Annual internal review	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Construction	Implement SLP	Throughout construction	Annual internal review	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Maintenance of grievance register	Throughout construction	Ongoing	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Stakeholder and Community liaison	Throughout construction	Ongoing	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement SLP	Throughout operation	Annual internal review	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Maintenance of grievance register	Throughout operation	Ongoing (weekly)	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

	Stakeholder and Community liaison	Throughout operation	Ongoing	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Stakeholder and Community liaison	Throughout decommissioning	Ongoing	Community Liaison Officer HR Department	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation and Closure	Continue community relations strategy until all activities on site cease and rehabilitation is completed	Until all rehabilitation activities have ceased.	Ongoing	Applicant (CLO) Continue until all rehabilitation activities have been completed	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
26. Social							
A	The potential impact on existing services and amenities must be discussed between the mine and the local authorities in the Mkhondo Municipality and with the Ward	Planning	Prior to construction	Applicant	ECO (Once-off) Independent Environmental Auditor (Annual)	Good relations with surrounding landowners & communities/	Established community liaison forum. Meeting Minutes (Community forum

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	Councillor.						meeting minutes) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The Applicant shall develop and implement a Workforce Code of Conduct to maximise positive employee behaviour in the local community, and optimise integration.	Planning Construction Operation Decommissioning	Prior to construction and ongoing	Applicant Contractor	ECO (Monthly) CLO (Annual) Independent Environmental Auditor (Annual)	Contribute to community health and safety. Obtain social licence to operate	Approved Workforce Code of Conduct. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
27. Relocation of Local Communities							
A	Should relocation become necessary the Applicant must appoint a relocation specialist to compile a relocation action plan according to best practice international standards such as the IFC Resettlement Guidelines and the World Bank Resettlement Guidelines	Planning & design	Process to commence once approval for project is given and need to relocate has been established.	Applicant	Relocation specialist	Ensure impacts on displaced people are managed and mitigated	Appointment of relocation specialist Internationally accepted relocation action plan
B	At such time as it proves necessary the Applicant must implement the relocation action plan and make provision for monitoring and management, as well as external audits	Long term	Long term until the people are established and their livelihoods are reinstated	Applicant	Relocation specialist	Ensure people are not worse off than before relocation.	Progress reports Monitoring reports External audits
28. Community Liaison							
A	The Applicant shall develop and implement a Stakeholder Engagement Plan in consultation with a suitably qualified specialist. This plan shall include a strategy to actively manage expectations. This includes the sharing of relevant information in a way that is accessible to all members of the community. Frequent communication is a key aspect in the management of expectations.	Planning	Prior to construction	Applicant	ECO (Once-off) Independent Environmental Auditor (Once-off)	Mitigate negative impacts of changes to social environment. Ensure social licence to operate and manage expectations	Approved Stakeholder Engagement Plan (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The mine shall appoint a community liaison officer that deals specifically	Planning	Prior to construction and ongoing	Applicant	ECO (Monthly) Independent	Good relations with surrounding landowners &	Appointment letter of community liaison officer.

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	with the surrounding communities. The Mine shall communicate frequently with the affected stakeholders to ensure that they understand the processes and do not develop more unrealistic expectations.				Environmental Auditor (Annual)	communities. Obtain social licence to operate Foster good relationships with neighbouring communities and manage unrealistic expectations	Assessment of grievances lodged in grievance register. (Community forum minutes) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports) (Grievance Register)
C	Open channels of communication between the Mine and surrounding landowners/communities are essential. The mine shall establish a community liaison forum (CLF) that meet on a regular basis (at least quarterly) – at this forum the mine can give feedback on its activities and keep the communities informed about matters that concern them in a transparent and honest manner. The CLF must be representative of all the groups in the area and include women, youth and the elderly. The relevant authorities shall also be invited to attend CLF meetings. This forum is an important mechanism to manage expectations and build relationships. Meeting minutes must be captured and forwarded to all attendees.	Planning Construction Operation Decommissioning	Prior to construction and ongoing	Applicant	ECO (Monthly) CLO (Bi-Annual) Independent Environmental Auditor (Annual)	Good relations with surrounding landowners & communities/	Established community liaison forum. (Community forum meeting minutes) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports) (Grievance Register)
C	Establish good working relationships with local and district government by attending their forums and individual interaction.	Planning & design Construction Operation	Before activities commence on site – continue for the life of the mine	Applicant Local and district municipality	CLO As needed	Ensure good relationships and coordinated planning	Membership of LED forums Minutes of meetings
D	The mine shall establish a detailed grievance mechanism for communities to lodge concerns, suggestions and grievances which can be dealt with by the Project in a timely manner. The grievance mechanism shall aim to	Planning Construction Operation Decommissioning	Prior to construction and ongoing	Applicant	HR Department ECO (Monthly) Independent Environmental Auditor (Annual)	Adequate procedures to ensure complaints are adequately recorded, tracked and addressed/	Completed community grievance mechanism Mechanism communicated to stakeholders and communities through a variety of media

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	accomplish the following objectives; • Receive and register external communications from the public; • Screen and assess the issues raised and determine how to address them; • Identify roles and responsibilities relating to the reporting, recording and addressing of grievances; • Maintenance of a grievance register to record and track, and document responses and actions taken to address grievances; • Reporting of grievances to DMR. • Adjust the management program, as appropriate.						(Grievance Register) (ECO Monthly Checklist/Report) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports) (CLF meeting minutes)
E	A grievance register must be maintained by the Applicant (Mine EO) to log grievances from landowners, communities, occupants and other Interested and Affected Parties, and response to such grievances. The grievance register should be provided to DMR on an annual basis, and at any point in time if requested by the DMR. The grievance register shall contain, at a minimum, the following information; • Date of the grievance being lodged, • Location relating to the grievance, • Contact details of the complainant, • Grievance description (detailed as possible), • Person receiving grievance, • Agreed corrective action, • Responsible party for corrective action, • Summary of actions taken (and	Planning Construction Operation Decommissioning	Prior to construction and ongoing	Applicant	HR Department ECO (Monthly) Independent Environmental Auditor (Annual)	Written record of all complaints and corrective action taken.	Tracking of grievances to ensure adequate corrective action has been taken. (Grievance Register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports) (CLF meeting minutes)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	date action was taken), • Status of grievance (open, closed-out, awaiting feedback etc.). The grievance mechanism must be communicated to all stakeholders and communities prior to the onset of construction.						
F	The grievance register shall be maintained by the Applicant (Mine EO) and shall be distributed to the ECO and Mine manager on a monthly basis.	Planning Construction Operation Decommissioning	Ongoing throughout lifespan of project	Applicant Mine EO	Mine EO (Ongoing) ECO (Monthly) Independent Environmental Auditor (Annual)	Communication of grievances and their status to ensure prompt resolution and close-out of grievances.	Tracking of grievances to ensure adequate corrective action has been taken in a timely manner. (Grievance Register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
29. Socio-Economic							
A	The Applicant shall ensure full market related compensation for any lost productive farm land due to mining activities.	Planning Construction Operation Decommissioning	Prior to construction and throughout the lifespan of the project.	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Good relations with surrounding landowners & communities.	Effective communication to maintain good relations and proactively address any potential complaints. (CLF meeting minutes) (ECO Monthly Checklist/Report)
B	The Applicant shall develop and implement a recruitment policy that allows equal opportunity to all people (woman, disabled) and give preference to local labour from Mkhondo Municipality. Communicate the policy and requirements to the affected communities through the media, community leadership and a community liaison forum. It is strongly recommended that “labour desks” or “labour offices” should be established in easy accessible areas to facilitate	Planning Construction Operation Decommissioning	Prior to construction and Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Maximise employment opportunities for the local labour force.	Approved Recruitment Policy. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	the labour recruitment process. No hiring shall take place at the gate.						
C	The mine should in consultation with the Mkhondo Local Municipality to develop targets for local employment that need to be met by the contractors appointed for the construction phase. These targets will need to be flexible and realistic given the low education and skills levels in the area. These requirements must be included in tender documentation and form part of the contractors contractual conditions.	Planning Construction Operation Decommissioning	Prior to construction and Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Maximise employment opportunities for the local labour force.	Approved Recruitment Policy. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	The Applicant shall comply with the conditions of the SLP developed for the mine to ensure the socio-economic benefits of the mine are maximised. The Independent Environmental Auditor shall be required to assess compliance with the SLP as part of the annual performance assessment and this requirement must be included in the scope of work for this assessment by the Applicant.	Planning Construction Operation Decommissioning Rehab &Closure	Prior to construction and Ongoing	Applicant	Independent Environmental Auditor (Annual)	Enhance positive impacts of the project on local/regional economy.	(SLP progress reports submitted to DMR) (Annual Performance Assessment Reports)
E	In addition to the implementation of the SLP, the mine shall investigate additional measures to ensure sound social performance and the maximisation of the socio-economic benefits of the project. These additional measures shall implemented by the mine wherever they are found to be feasible and appropriate. This includes, but shall not be limited to: • Development of a business forum and ongoing engagement with SMME's at the business forum to ensure that local businesses are utilized where possible; • Engage with NGO's that are active	Planning Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Maximise socio-economic benefits of the project	Social an Labour Plan (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	in the area. Look for partnerships and ways of working together. Mine to approach NGO's to suggest working together; • Analyse avenues to undertake import substitution and material beneficiation to increase economic activities in the surrounding areas. • Enter in discussions with other mines in the area about potential opportunities for sharing resources related to skills development e.g. training courses and internship agreements; • Provide business mentorship to identified local businesses through forums run by the Chambers of Commerce/Business forums; • Where practical, investigate opportunities for integration of Project apprentices into local businesses to facilitate skills transfer to the local community. • Enter in discussions with other mines in the area about potential opportunities for sharing resources related to skills development e.g. training courses and internship agreements. • Maintain good working relationships with local and district government by attending their forums and individual interaction; • Invest in skills development plans, bursaries and internships to ensure scarce skills will be available in time; • Provide housing subsidies and encourage staff that travel from outside the municipal area to reside locally through incentives						

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	such as preferential skills development opportunities for local residents.						
F	The Applicant shall undertake a survey of the available labour force and skills levels in the area prior to the commencement of the Project, in order to identify suitably qualified individuals for training programmes and employment.	Planning Construction Operation Decommissioning	Ongoing	Applicant Contractor	ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure legal compliance in terms of labour and employment.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	The Applicant and Contractor(s) shall comply with all relevant legislation pertaining to labour recruitment and employment.	Planning Construction Operation Decommissioning	Ongoing	Applicant Contractor	ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure legal compliance in terms of labour and employment	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	The Applicant shall undertake a skills survey of the workforce and shall a program for training and upliftment of the workforce. This should consider but shall not be limited to: • Provide training to employees on wealth management. For example, the importance of saving and paying of bonds on properties to anticipate eventual retrenchment due to mine closure; • Implement workforce education programs on cultural diversity and tolerance.	Planning Construction Operation Decommissioning	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Upliftment of the workforce through education, training and skills development.	Strategic agreement about skills development in the region. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
30. Local/Regional Infrastructure							
A	Engage with the municipalities to discuss strategic long-term planning with regard to services such as road maintenance and housing. Coordinate the outcomes of the Social and Labour plan with the Integrated Development Plans of the municipalities. The Applicant should become a member of the IDP Forum.	Planning	Prior to construction	Applicant	ECO (Monthly) CLO (Annual) Independent Environmental Auditor (Annual)	Minutes of meetings Social and Labour Plan	Membership of IDP Forum (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	Plan for worker accommodation well	Planning	Ongoing	Applicant	Mine EO	Proper planning to ensure	Minutes of meetings with

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	before the proposed onset of the project. This relates to housing and associated services. Integrate planning process with local government – make sure it is in line with spatial development planning of the area.	Construction			(Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	workers accommodation is ready prior to commencement of work and that it aligns with local governments integrated development planning.	local planning departments (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
31. Social impacts arising from impacts on the environment							
A	The Mine shall engage with agriculture community with regard to dust suppression strategies that minimize the impact on their produce.	Planning Construction Operation Decommissioning	Prior to construction and Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Maintain good relations with agricultural community and identify and implement appropriate measures to address dust impacts	Verification that agricultural communities have been engaged regarding dust impacts. (Meeting minutes) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The mine shall establish an environmental forum to give feedback to affected communities twice a year regarding environmental aspects such as dust, water and noise pollution and how the Leiden mine manage and mitigate these aspects.	Planning	Established prior to construction and meeting Bi-Annually	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Maintain communication and good relations with community	Verification that environmental forum is established and continues to meet bi-annually. (Meeting minutes) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The mine shall obtain baseline data about water resources and boreholes on neighbouring properties before any activities start, and provide affected parties with the information. This information should be kept for the life of the mine to use as evidence in any disputes. Monitor against these baselines and release the monitoring results to affected parties.	Construction Operation	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Baseline data to serve as evidence in the case of disputes. Baseline reports	Monitoring results (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	The Applicant will investigate the option of tarring the access road to the site.	Planning & design	Before construction activities commence	Applicant in partnership with provincial	N/a	Mitigate road safety risks, reduce maintenance of vehicles, enhance social	Tarred/re-surfaced road

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
				roads authority		licence to operate	
32. Community Health and Safety							
A	The mine is encouraged to form a partnership with a Non Profit Organisation (NPO) to provide the necessary social services to people whose lives are affected by infectious diseases.	Planning Construction Operation Decommissioning	Ongoing	Applicant	ECO (Monthly) CLO (Bi-Annual) Independent Environmental Auditor (Annual)	Contribute to community health and safety.	Written partnership agreement in place. Monitoring and evaluation reports from NPO (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The mine shall develop and implement an infectious diseases management plan to address health issues with the workforce. The mine shall align the strategy with a community HIV strategy. This strategy should include but not be limited to: The formation of an AIDS Task Force for the project with representatives from unions, management, local community members and people living with HIV. The extension of the workplace programme for HIV beyond the company's operations, and include all contractors, suppliers, transportation companies and local communities. The spread of HIV along transportation routes (roads and railways) is well documented, so this component of the project (transportation of all goods and services to and from the project site) needs special attention. • Select suppliers who have in-house HIV programmes and policies in place; • Develop tailored behaviour change communication (BCC) materials such as mirror hanger	Planning Construction Operation	Ongoing	Applicant	ECO (Monthly) CLO (annual) Independent Environmental Auditor (Annual)	Documented strategy	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	messages and bumper stickers; • Include condoms in the road safety kit; Work with truck company managers to ensure that their drivers receive adequate HIV training;						
C	The mine shall encourage workers to live in established residential areas. Provide transport from these areas to the mine.	Construction Operation	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Signed transport agreements with relevant service providers.	(ECO Monthly Checklist/Report)
D	Implement a Health and Safety Program on site, including safety consciousness and awareness training. The program should also include relevant health aspects, e.g. sexual health, fatigue management, social health.	Planning Construction Operation Decommissioning	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Health and safety of employees.	Provision of safety training on site to all workers. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	The Applicant shall provide advanced communication (i.e. signage, advertisements in local papers) about changes to local access, potential road hazards and expected traffic volumes during construction.	Planning Construction Operation	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Design of appropriate signage and communication material.	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	The Applicant shall develop an Employee Assistance Program (EAP) to assist employees in dealing with personal issues and minimise impact on family assistance services locally.	Planning Construction Operation	Ongoing	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Approved EAP provided to employees and their immediate family members.	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	The applicant shall ensure that employees are afforded access to basic health care facilities. The applicant should investigate the possibility of Establishing a basic clinic for the employees at the plant one day a week where they can receive chronic medication and primary health care, including free anti-retrovirals (sourced from Department of Health). This service can be provided by a sub-	Construction Operation	Once activities on site commence	Applicant Sub-consultant Department of Health	Applicant Quarterly	Save time lost to workers going to the clinic, injuries on duty and absenteeism	Running clinic

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	contractor or mobile clinic.						
J	Develop a gender-specific outreach programme for the project. It can target schools, clinics and the youth, and should also include internal awareness formation. It must be presented in a culturally sensitive manner to ensure it does not create tension inside communities. (pull into stakeholder engagement plan above)	Construction Operation	When activities on site commence	Applicant	CLO Quarterly	Ensure equal opportunities and awareness of gender impacts. Meet DEA requirements	Gender-specific outreach programme

21.4 GEOCHEMISTRY

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	**ACTIVITY**	**IMPACT**	**SIGNIFICANCE**		
			Pre-mitigation	**Post-mitigation**	**FINAL Significance**
Planning	N/A	N/A	N/A	N/A	N/A
Construction	N/A	N/A	N/A	N/A	N/A
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Sewage and sanitation (GNR 544 Activity 55A; GNR 545 Activity 27; Category B Activity 4) General site management Excavations Establishment of internal haul roads (GNR 544 Activity 22 and 39)	Impact of AMD on stream ecology	-16.25	-9	-18
		Mobilisation of heavy metals	-16.25	-9	-18
		Limitations on beneficial downstream water uses	-16.25	-8.25	-16.5
		Alteration of water chemistry balance	-16.25	-9	-18
		Development of chemical precipitates	-16.25	-9	-18
		Development of acid conditions	-16.25	-9	-18
		Long term environmental liabilities	-16.25	-9	-18

	Pumping of water to PCD's (GNR 544 Activity 9) Water management (Category B Activity 4 and 5) Concurrent rehabilitation Water treatment	Limitations on mine site water reuse	-16.25	-9	-18
Decommissioning	Dismantling and demolition of infrastructure	Impact of AMD on stream ecology	-18.75	-5.5	-11
		Mobilisation of heavy metals	-18.75	-5.5	-11
		Limitations on beneficial downstream water uses	-18.75	-18.75	-37.5
		Alteration of water chemistry balance	-18.75	-5.5	-11
		Development of chemical precipitates	-18.75	-9	-11
		Development of acid conditions	-18.75	-5.5	-11
		Long term environmental liabilities	-18.75	-5.5	-11
		Limitations on mine site water reuse	-18.75	-5.5	-11
Rehabilitation & Closure	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns Remediation of ground and surface water Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Impact of AMD on stream ecology	-18.75	-8.25	-16.5
		Mobilisation of heavy metals	-18.75	-8.25	-16.5
		Limitations on beneficial downstream water uses	-18.75	-8.25	-16.5
		Alteration of water chemistry balance	-18.75	-8.25	-16.5
		Development of chemical precipitates	-18.75	-8.25	-16.5
		Development of acid conditions	-18.75	-8.25	-16.5
		Long term environmental liabilities	-18.75	-8.25	-16.5
		Limitations on mine site water reuse	-18.75		

AMD MANAGEMENT STRATEGY

An **AMD Management Strategy** has been developed by the Geochemist, details of which are provided in the specialist report

This strategy is based on the following principles, but shall not be limited to:

- Responsible management of sulphidic mine wastes;
- Development and implementation of site specific strategies to prevent, minimise and control AMD (e.g. the oxidation of sulphides);
- Integration of AMD mitigation strategies into the actual mining process (e.g. Integration with soil management and progressive rehabilitation);
- Continued characterisation and classification of acid generating potential as more samples and data become available;
- Implementation of long term control and treatment technologies (consideration of both passive and active treatments); and
- Ongoing review and implementation of best available technology to mitigate and treat AMD where appropriate and feasible.

It is important to note that for the AMD mitigation to be effective, the necessary actions need to be undertaken throughout operation and not just during the rehabilitation and closure phase. As such a commitment has been included in this document that requires the Applicant to develop a detailed, site specific AMD management plan based on the above mentioned strategy. This plan shall be developed as soon as possible in the life cycle of the mine to ensure the management measures are implemented throughout the lifespan if the mine to firstly avoid and secondly mitigate

AMD.					
IMPLEMENTATION PLAN					
Phase	Management Action	**Timeframe for Implementation**	**Review/Repeat frequency**	**Responsible Party For Implementation**	**Responsible Party For Monitoring and Review**
Planning	Appoint specialist to develop detailed, site specific AMD mitigation plan as per the AMD mitigation strategy	Prior to construction	Annual internal review	Applicant	ECO (Monthly audit) Independent Environmental Auditor (Annual)
Construction	Implement AMD Management Plan	Throughout construction	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement AMD Mitigation Plan	Throughout operation	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement AMD Mitigation Strategy	Throughout decommissioning	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Implement AMD Mitigation Strategy	Throughout rehabilitation	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental

					Auditor (Annual)
	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
33. A							
A	Appoint specialist to develop detailed, site specific AMD management plan	Planning, Construction, Operational, Closure	Prior to construction but ongoing throughout the project	Applicant	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual	Minimisation of impact of AMD	AMD management (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	It is essential that groundwater links and potential decant points be accurately identified. Ideally, mining should be restricted to one quaternary catchment. The latest available technology to reduce ingress and AMD should be continually reviewed.	Planning, Construction, Operational, Closure	Prior to construction but ongoing throughout the project	Applicant	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual	Accurate identification of decant points and avoidance of wetland areas	limited ingress of water (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	Where acid mine drainage is anticipated or detected, an Acid-Base Accounting Technique and Evaluation (ABATE) should be initiated. Where the expected water quality is acidic of highly alkaline, mitigation measures will need to be investigated and implemented (such as impermeable linings for the coal stockpiles and treatment of mine water.)	Planning but ongoing during operational, decommissioning and closure.	Project initiation	Applicant	Applicant	No acidification or alkalinisation of surface water. (Surface and ground water monitoring)	No acidification or alkalinisation of surface water. (Surface and ground water monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Provision must be made for the long-term treatment and/or management of water collecting in mined out voids.	Planning, Operational, decommissioning,	Prior to construction but ongoing throughout	Applicant, ECO	Applicant, ECO	Treated or decanting water complies with target water quality variables (as	Compliance with WUL/DWA stipulations (Water quality and

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	Water that decants or is pumped from mined out areas will need to comply with target water quality variables and flow requirements of downstream watercourses (as advised by DWA).	closure	the project			advised by DWA).	quantity monitoring)*
E	After closure, mine water and/or decant needs to be treated to the required level before discharge into natural watercourses. The extent of treatment required, as well as the duration of treatment needs to be determined by water quality assessments.	Operational - Closure	To be determined during Operational Phase. At least 5 years after closure.	Applicant, ECO	ECO (monthly)	No decline in water quality in receiving watercourses (water quality monitoring)	No decline in water quality in receiving watercourses
B	The Applicant must investigate further the best options for site specific treatment of AMD. Treatment techniques are usually reactive rather than pro-active, and are generally designed to: i. raise pH, ii. lower toxic metal concentrations (e.g. precipitation, adsorption) iii. lower aqueous sulphate concentrations, iv. lower the toxicity / bioavailability of metals in solution (e.g. oxidation, reduction) v. oxidise the solution (e.g. Fe(II)-Fe(III), Mn(II)-Mn(IV), As(III)-As(V)), vi. reduce the solution (e.g. SO42-, H2S) vii. collect / dispose / isolate the metallic sludge generated. Acid drainage control and treatment techniques can be broadly classified into physical, chemical and biological,						

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	and those using combinations of these. As per the Geochemistry report (Appendix XX) the following treatment techniques should be applied as below.						
C	Dilution / Reaction	Operational, Decommissioning	Wet season	Mine manager	ECO	Dilution to background water quality values.	Background water quality values
D	Evaporation concentration	Operational, Decommissioning	Continual	ECO	ECO	Background water quality values	Background water quality values
E	Chemical Treatment Methods Active Treatment	Operational, Decommissioning	Emergency situation.	ECO	ECO	pH - 7	pH values
F	Chemical Treatment Methods Passive Treatment	Operational, Decommissioning	When volumes allows	ECO	ECO	pH - 7	pH values
G	Biological treatment	Operational, Decommissioning	Following chemical/passive treatment as mentioned above.	ECO	ECO	Sulphate value < 400	SO_4 values
H	Chemical & Biological Treatment	Operational, Decommissioning	Depend on water quality	ECO	ECO	6 < pH < 9 Sulphate <200	pH and SO_4 values
I	Review and update AMD management plan every two to three years	Operation	Every two to three years	Applicant Specialist	ECO		

21.5 SOILS, LAND USE, AND LAND CAPABILITY

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance

Planning	Exploration and geotechnical surveying Environmental studies and design	Loss of soil fertility	1	1	1.67
		Soil compaction	-1	-1	-1.17
		Soil pollution/contamination	-1	-1	-1.17
		Soil surface subsidence	-1	-1	-1.17
Construction	Vegetation clearance Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads (GNR 544 Activity 22) Upgrading existing roads (GNR 544 Activity 47) Establishing stormwater management measures (GNR 544 Activity 11) Establishment of Eskom substation (GNR 544 Activity 10)	Loss of soil fertility	-7.5	-5.5	-6.42
		Soil compaction	-5.5	-5	-5.83
		Soil pollution/contamination	-5.5	-5	-5.83
		Soil surface subsidence	-2.25	-4.5	-5.25
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Establishment of mobile office and ablution block Sewage and sanitation (GNR 544 Activity 55A; GNR 545 Activity 27; Category B Activity 4 and 5) Establishment of fuel storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of chemical storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of explosives storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of general and hazardous waste areas (Category C Activity 1 and 2) Drilling Blasting Excavations Removal of overburden by dozing and load	Loss of soil fertility	-8.25	-2.75	-3.21
		Soil compaction	-8.25	-8.25	-9.53
		Soil pollution/contamination	-9	-5	-5.83
		Soil surface subsidence	-6	-4.5	-5.25

	haul Establishment of internal haul roads (GNR 544 Activity 22 and 39) Waste rock dumps for backfilling Soil management Concurrent rehabilitation				
Decommissioning	Dismantling and demolition of infrastructure Blasting Safety control	Loss of soil fertility	-8.25	-5.5	-6.42
		Soil compaction	-11	-8.25	-9.63
		Soil pollution/contamination	-9	-5	-5.83
		Soil surface subsidence	-6	-4.5	-5.25
Rehabilitation & Closure	Backfilling of pits and voids Slope stabilisation Erosion control Landscaping Replacing topsoil Removal of alien/invasive vegetation Re-vegetation Restoration of natural drainage patterns Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Loss of soil fertility	-8.25	-5.5	-6.42
		Soil compaction	-11	-8.25	-9.63
		Soil pollution/contamination	-8.25	-5	-5.83
		Soil surface subsidence	-6	-4.5	-5.25

SOIL MANAGEMENT STRATEGY

The action plan for managing impacts on soil, land use and land capability is based on the following principles:

- Define an end-use for the area. This should be established as soon as possible;
- Define and agree upon end-goals for the rehabilitation process, such as land use, rehabilitation objectives, areas to be rehabilitated, etc.;
- Ascertain whether the proposed end-use is compatible with the land capability of the area;
- Minimise visual impacts of rehabilitated areas by recreating natural landforms and ensuring that reshaped areas are visually compatible with surrounding landscapes;
- Restore natural landforms such as drainage lines, undulating areas and ridges (which may have been damaged during activities);
- Quantify, restrict and remediate chemical environmental pollution of water and soil as a result of the various mining activities;
- Ensure post-mining soil integrity. This is the most important aspect of rehabilitation as it forms the base from which rehabilitation proceeds. If soils are not correctly prepared, suitable conditions for re-vegetation will not be achieved;
- Monitor and combat alien floral invasion, as this also poses a threat both during and post-rehabilitation activities. Adequate alien and invasive species control measures must be applied.

Identification and recording of soil and terrain units prior to disturbance is an essential part of the planning process. These units must then, as far as possible, be re-instated during rehabilitation to maintain habitat diversity and consequently biodiversity. These units were defined in the soil and land capability study by the method of soil classification and allocating soil form units into land capability classes.

The above strategy aims to prevent, reduce and mitigate impacts to soil and land capability in terms of;

- Loss of soil fertility;
- Loss of agricultural potential;
- Soil erosion;
- Soil compaction;

- Pollution of soils;
- Change in natural landscape.

IMPLEMENTATION PLAN					
Phase	Management Action	**Timeframe for Implementation**	**Review/Repeat frequency**	**Responsible Party For Implementation**	**Responsible Party For Monitoring and Review**
Construction	Control storage of removed soil	As excavations progress	Monthly	Environmental Manager	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant/Contractor	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Stockpiling of removed soil	As excavations progress	Half-yearly	Environmental Manager	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Replacement of stockpiled soil	As soon as operations cease	Monthly	Environmental Manager	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Loosening, fertilization and re-vegetation of soil	From cessation of operations until full vegetation cover	Monthly for first rainfall season, half-yearly thereafter	Environmental Manager	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
34. Topsoil and Sub-Soil Management							
A	Where practically possible, soil will be stripped during dryer and less windy months when soils are less susceptible to erosion and compaction.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Protection of soil resources.	Visual observation that soil management guide is being adhered to. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	During the construction phase, a representative sampling of the stripped soils must be analysed to identify utilizable materials for rehabilitation. As a minimum the following elements will be tested for: EC, CEC, pH, Ca, Mg, K, Na, P, Zn, Clay% and Organic Carbon. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary during rehabilitation.	Construction	Ongoing	Applicant Contractor	ECO (Monthly) Independent Environmental Auditor (Annual)	Protection of soil resources.	Soil sampling results (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Erosion control measures must be implemented to ensure that the soil is not washed away and that erosion gulleys do not develop prior to vegetation establishment.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Protection of soil resources.	Visual observation that soil management guidelines in this EMPR are being adhered to. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	Topsoil shall be removed from all areas where physical disturbance of the surface will occur (up to a maximum of 30 cm depth). Topsoil must be stockpiled for re-use in subsequent rehabilitation activities	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental	Adequate topsoil stripped for successful rehabilitation.	Visual observation that sufficient topsoil is stripped. (Mine EO weekly checklist) (ECO Monthly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	outside of areas prone to erosion and 1:100 year flood plain demarcation.				Auditor (Annual)		Checklist/Report) (Annual Performance Assessment Reports)
G	To the greatest extent possible topsoil shall only be handled twice, only-once during the initial stripping of topsoil and a second time to replace it.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimal impact on soil structure and fertility.	Visual observation that topsoil handling complies with EMPR conditions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	It must be ensured that the topsoil is separated from the subsoil and that the topsoil is stockpiled separately from the subsoil and construction materials.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimal loss, dilution or contamination of topsoil.	Visual observation that topsoil stockpiles comply with EMPR conditions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	To prevent the development of anoxic conditions, soil compaction and loss of soil biota, stripped topsoil will be placed/stored in stockpiles which must be limited in height (preferably not exceeding 2 meter in height), and storage shall be for the shortest period possible. It is recommended that any topsoil stockpiles that are expected to remain in place for longer than 30 days be reseeded with an appropriate indigenous grass seed mix (to be approved by the ECO).	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Successful rehabilitation.	Visual observation that topsoil storage complies with EMPR conditions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Topsoil and sub-soil stockpiles must be located such that the potential for erosion is minimised. Areas with existing erosion and stability issues must be avoided. Topsoil stockpiles will not be placed within the 1:100 year	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental	No erosion of topsoil.	Visual observation of topsoil stockpile locations/Visual inspection for signs of erosion. (Mine EO weekly checklist)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	floodline of a water course, and will not be placed within the path of a stormwater channel, and if necessary, will be provided with a silt fence around the perimeter of the foot of the stockpile (as directed by ECO). Stockpiles are to be stabilised if signs of erosion are visible. Any evidence of erosion, scouring, sedimentation, and/or undercutting must be rectified and rehabilitated immediately.				Auditor (Annual)		(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
K	Compacting of soil must be avoided as far as possible. The contractor should restrict the use of heavy machinery, particularly in areas outside of the physical mining footprint area to reduce the compaction of soils. No vehicles or machines will be allowed to drive over or be parked on the topsoil stockpiles.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No impact on topsoil structure.	Visual inspection of topsoil stockpiles for signs of compaction/vehicular movement. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
L	The growth of weed species on the stockpile will be controlled. Appropriate measures shall be taken to prevent the establishment of seed bank or accumulation of other propagules of alien invasive plants within/on the topsoil stockpile as directed by the ECO.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent spread of alien vegetation.	Visual observation of stockpiles. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
M	Topsoil shall be used for rehabilitation purposes only. During rehabilitation, all reasonable efforts should be made to return soil in reverse order to which it was removed, thereby retaining the correct soil profile, ensuring that topsoil is replaced last. Under no circumstances should subsoil be placed on top of topsoil.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Reinstate functional ecosystem by maintaining ecosystem processes.	Visual observation during backfilling. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
R	There must be no contamination of topsoil. The biological, chemical and	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily)	No contamination of topsoil.	Visual inspection of topsoil stockpiles.

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	physical properties of the topsoil must not be changed by introducing detrimental foreign material, gravel, rock, rubble or mine residue to such soil (MPRDA Regulation 70(7)). This also includes littering, waste disposal, fuel or chemical contamination, plant matter dumping or other activity occurs that may introduce pollutants or foreign plant species into stockpiled soils. Material laydown areas and stockpiles of construction materials must be clearly separated from topsoil stockpiles in order to limit any contamination of the topsoil.	Decommissioning Rehab &Closure			Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)		(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
S	Should any topsoil become polluted with a hazardous substance, the polluted soil should be managed as hazardous waste as described elsewhere in this EMP.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No contamination of the environment.	Visual inspection of topsoil stockpiles. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
T	Care must be taken to protect topsoil resources on site and thereby avoid the need to obtain additional topsoil from outside the site for rehabilitation. However, in the event that additional topsoil needs to be sourced from outside the site, this shall be done with extreme caution not to introduce any alien or invasive species to the site. The topsoil shall be sourced from a location approved by, and a standard, acceptable to the ECO.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent establishment of alien vegetation.	Visual observation that topsoil is sourced from an appropriate, legal source. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

21.6 FLORA

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Planning		Invasive species encroachment	-4.5	-4	-5.33
		Erosion potential	-2	-2	-2.67
		Dust	-7	0	0
Construction	Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads (GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11) Establishment of firebreak Establishment of Eskom substation (GNR 544 Activity 10)	Invasive species encroachment	-9.75	-6.75	-10.13
		Erosion potential	-9	-4.5	-6
		Dust	-9	-6.75	-7.88
		Pollution on vegetation	-16	-7.5	-8.75
		Altered hydrology and geohydrology	-7.5	-6	-7
Operation	Mixing on concrete and concrete works Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Establishment of mobile office and ablution block Sewage and sanitation (GNR 544 Activity 55A; GNR 545 Activity 27; Category B Activity 4 and 5) Establishment of fuel storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of chemical storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of explosives storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of general and hazardous waste areas (Category C Activity 1 and 2)	Invasive species encroachment	-14	-6.75	-10.13
		Erosion potential	-6	-4.5	-6
		Dust	-13	-9	-10.5
		Pollution on vegetation	-16	-7.5	-8.75
		Altered hydrology and geohydrology	-7.5	-6	-7

	Drilling Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads (GNR 544 Activity 22 and 39) Waste rock dumps for backfilling Soil management Concurrent rehabilitation General site management Drilling Establishment of RoM stockpiles RoM stockpile transport Waste rock dumps for backfilling Soil management Water management Concurrent rehabilitation Water treatment (Category B Activity 4 and 5)				
Decommissioning	Dismantling and demolition of infrastructure Alien vegetation control	Invasive species encroachment	-14	-6.75	-9
		Erosion potential	-6	-4.5	-6
		Dust	-13	-9	-10.5
		Pollution on vegetation	-16	-7.5	-8.75
		Altered hydrology and geohydrology	-7.5	-6	-7
Rehabilitation & Closure	Blasting Safety control Backfilling of pits and voids Slope stabilisation Erosion control Landscaping Replacing topsoil Removal of alien/invasive vegetation Re-vegetation Restoration of natural drainage patterns Remediation of ground and surface water Rehabilitation of external roads Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Invasive species encroachment	-13	-6.75	-9
		Erosion potential	-4.5	-4.5	-6

FLORA MANAGEMENT STRATEGY

The action plan for managing impacts on Flora shall be accomplished through the development and implementation of a **Biodiversity Management Plan**. The Biodiversity management is based on the following principles:

- A biodiversity management plan may include individual species action plans as well as habitat or biodiversity feature action plans;
- A biodiversity management plan is characterised by a proactive and coordinated approach that directs, monitors and reviews the effective management of key biodiversity features of

the land holdings of a particular land steward;
- A biodiversity management plan includes conservation projects, protection agreements and productive partnerships with stakeholders that deliver sound land use stewardship;
- A biodiversity management plan realizes the potential that responsible biodiversity management has to generate sustained economic benefits for local communities;
- Awareness program: raising awareness regarding biodiversity issues as part of an ongoing program to educate and train employees in the benefits of conserving biodiversity;
- Research: an important step in understanding and better managing biodiversity in and around the relevant land areas;
- Restoration and rehabilitation projects: aim to re-establish or supplement habitat that has been impacted upon, in order to assist in the re-colonization of endemic species.

The implementation plan and detailed technical management options below and in the Section 21.7 and the relevant specialist reports form the basis of the Biodiversity Management Plan. This must be finalised into a standalone plan that can be updated and amended as required.

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review
Planning	Apply for permit to impact on protected species identified on site if required.	Before construction commences	Once-off	Applicant / Consultant	Consultant (before construction commences)
	Finalise biodiversity action plan	Prior to commencement	Once-off	Applicant	ECO (Monthly audit) Independent Environmental Auditor (Annual)
Construction	Demarcate primary vegetation communities within 100 m of the development site to be avoided.	Once-off at start of construction, then maintenance	Once-off	ECO (weekly)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Adhere to the requirements of any permits.	Throughout construction	Ongoing	ECO (weekly)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Review and update the control methods and species to be controlled	Every three years	Every three years	Vegetation specialist / invasive species control specialist (every 3 years)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Review and update the relevant sections of the biodiversity management plan and other documentation when the legislation changes	As needed	Ongoing	Vegetation specialist / invasive species control specialist (as needed)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement biodiversity management plan	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit)

					Independent Environmental Auditor (Annual)
	Monitor biodiversity management plan	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Review and update the control methods and species to be controlled every three years	Every three years	Every three years	Vegetation specialist / invasive species control specialist (every 3 years)	ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Review and update the relevant sections of the biodiversity management plan and other documentation when the legislation changes	As needed	Ongoing	Vegetation specialist / invasive species control specialist (as needed)	ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Monitor biodiversity management plan	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Monitor biodiversity management plan	Throughout decommissioning	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

	Review and update the control methods and species to be controlled every three years	Every three years	Every three years	Vegetation specialist / invasive species control specialist (every 3 years)	ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Review and update the relevant sections of the biodiversity management plan and other documentation when the legislation changes	As needed	Ongoing	Vegetation specialist / invasive species control specialist (as needed)	ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Monitor biodiversity management plan	Throughout rehabilitation	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Review and update the alien vegetation control methods and species to be controlled	Every three years	Every three years	Vegetation specialist / invasive species control specialist (every 3 years)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Review and update the relevant sections of the biodiversity management plan and other documentation when the legislation changes	As needed	Ongoing	Vegetation specialist / invasive species control specialist (as needed)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
35. Flora							
A	Vegetation clearing will be done in phases.-Only the areas requiring clearance at a specific point in time for construction activities to take place.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
					(Annual)		Assessment Reports)
B	Vegetation to be stripped and stored as part of the utilizable soil during rehabilitation.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	Discard shall be compacted and cladded.	Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Compacted soils shall be ripped and topsoil will be replaced.	Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place.	Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	The harvesting of plants by construction and mine workers are prohibited on site. This includes the harvesting of plants for firewood, construction material, the making of crafts and medicinal purposes.	Construction & operation	Through life of mine	Environmental officer, construction team	ECO (prior to construction)	No damage to vegetation outside the mining area	No unauthorised activities taking place outside the mining area (checklist)
36. Site Clearance							
A	Should any threatened or Red Data species be encountered on the site, in situ conservation is unlikely to be successful and it is recommended that a specialist be consulted for possible relocation.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No disturbance or harm to threatened or red data species.	(Contractor EO weekly checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
							(Annual Performance Assessment Reports)
B	The area where vegetation will be cleared for construction and mining should be kept to the minimum area required to limit disturbance to vegetation and soil.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise construction footprint.	Limit area cleared to minimum area required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
37. Sensitive Areas, Fauna and Flora							
B	The destruction of sensitive landscape features shall be avoided where possible and otherwise minimised through effective planning. In areas where the destruction cannot be avoided, these features should be re-introduced in the post mining landscape.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise destruction of habitat and minimise losses of biodiversity.	Observation that sensitive landscape features are avoided where possible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	Where possible infrastructure should be kept on already transformed areas such as cultivated fields, forestry stand and existing homesteads. Existing infrastructure should rather be upgraded and development kept together rather than developing new infrastructure away from existing infrastructure. Construction should be planned so that migratory corridors are not destroyed to allow for regional species viability.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise destruction of habitat, loss of biodiversity and fragmentation.	Verification that EMPR condition is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Infrastructure should be designed to rather follow the edge of natural areas than crossing it. If crossing it is the only option, then the area should be transected so that one large area remains rather than two equally sized areas. Infrastructure should be condensed to prevent unnecessary	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise habitat loss and fragmentation.	Verification that EMPR condition is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	sprawl into sensitive areas.						Assessment Reports)
E	The staff of the mine should be educated/ informed about the risk that the introduction of foreign species have on the indigenous species.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No introduction of foreign species.	(Awareness training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	The workforce should be informed that it is illegal to harvest natural resource without the relevant permits and should be prosecuted if found in transgression of the law.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Avoid direct impacts on flora and flora and minimise loss of biodiversity.	(Awareness training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	All staff and workers on site shall be informed of the no-go areas on site. Follow-up training should be conducted from time to time to reinforce the sensitivity and access restriction to these areas and disciplinary action should be taken against any person that does not comply with these restrictions.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No access or impact on demarcated sensitive areas/Visual observation that access to no-go areas is prevented. (Mine EO weekly checklist)	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
L	Damage or harm to threatened plant species is illegal in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004). Threatened species are defined in terms of the most recent Red Data list of Southern African Plants. Employees and workers shall be educated with regards to any potential threatened species that may be encountered on site, and shall take the necessary actions to prevent of harm to any such species found on site.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No harm to any threatened or red data list plants.	Appropriate environmental training. (Training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
38. Rehabilitation of Vegetation							
A	Reinstate the soil over the open cast mining area to the following standards	Decommission & Rehabilitation	Entire decommission and	Rehabilitation team	ECO (monthly)	Correct soil cover	Soil cover is correct and topsoil is in place (Mine

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	• at least 1.5m deep, preferably the same as before construction, • in the correct soil profile order • add mulching • and soil stabilisation measures • and ensure that the vegetation cover is evenly spaced with an initial basal cover of 15% with pioneer species		rehabilitation phase				EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	Spread an applicable seed mix of indigenous grass seeds over the areas to be rehabilitated.	Rehabilitation	Approximately a year	Rehabilitation team	ECO (monthly)	Correct seed mix applied	Vegetation growth on site is sufficient (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	Reinstating the area to forestry plantation is not recommended since the roots are likely to penetrate through the soil covers over the pit required to seal the soil from excess ingress of water.	Planning & Rehabilitation	Rehabilitation	Planning & rehabilitation team	ECO (monthly)	Vegetation cover is correct	No invasive trees are present (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	A single application of fertilizer is recommended for the seeded areas to promote growth.	Rehabilitation	Rehabilitation phase	Rehabilitation team	ECO (monthly)	Vegetation cover is correct	Documentation of process available (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Mowing of the grass cover will promote the growth of the grass cover and increase the total cover area, this will also help control the growth of weedy species.	Rehabilitation	2 years	Rehabilitation team	ECO (monthly)	Vegetation cover is correct	Documentation of process available (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
							(Annual Performance Assessment Reports)
39. Alien Vegetation							
A	All alien vegetation occurring on the site must be controlled in accordance with NEMBA. The area should be assessed and the alien invasive species controlled prior to the commencement of the construction activities. The area should be monitored for the establishment and spread of alien invasive species during and after the construction phase. The weed management plan and principles for weed management presented in this EMPR must be implemented throughout the lifespan of the project.	Planning Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent establishment and spread of alien vegetation.	Visual observation that alien vegetation is adequately controlled in accordance with EMPR provisions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	All soil stockpiles shall be kept free of any weeds or alien invader plant species.	Construction Operation	Throughout the lifespan of the project	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent establishment and spread of alien vegetation.	Visual observation that alien vegetation has been controlled. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	All new infestation of invasive plant species in the mining areas must be removed.	Construction, Operation, Decommission & Rehabilitation	Entire lifetime of the mine	Environmental officer	ECO (Bi-annually)	Ensure compliance with relevant legislation.	The number, cover abundance and size of alien species to be monitored, as well as area covered (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	No invasive species may be present within 20m of a wetland and must be removed.	Construction, Operation, Decommission &	Entire lifetime of the mine	Environmental officer	ECO (Bi-annually)	Ensure compliance with relevant legislation.	The number, cover abundance and size of alien species to be

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
		Rehabilitation					monitored within 20m of wetland, as well as area covered (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Removal must take place in an appropriate manner, which includes: • Avoid disturbance to the soil. • Use an appropriate control for each species. Some species may require manual and herbicide control. Where appropriate, use biological control. • Where herbicide control is used, ensure that the correct herbicide as registered for the species is used. • Use only herbicides that are registered for use near water close to the wetland areas. • In most cases herbicide control is only successful in the growing season. All herbicides must be applied appropriately.	Construction, Operation, Decommission & Rehabilitation	Entire lifetime of the mine	Environmental officer	ECO (Bi-annually)	Ensure compliance with relevant legislation.	Secondary impacts from the alien control, such as effects on indigenous vegetation (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	Where large clumps of invasive trees are to be controlled, do not clear all invasive species at once, since this will lead to large areas bare of vegetation and will lead to erosion and a large sediment load in the water. Aliens must be removed gradually over a long period and the trees replaced with grassland	Construction	2 years	Environmental officer	ECO (Bi-annually)	Clear invasive species without causing excess erosion.	Control of invasive species without secondary impacts (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Clearing of invasive species must take place in the mining area bi-annually.	Construction, Operation, Decommission & Rehabilitation	Entire lifetime of the mine	Environmental officer	ECO (Bi-annually)	Control on invasive species before seeding	The number, cover abundance and size of alien species to be monitored, as well as area

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
							covered (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	Alien control on the rehabilitated areas must take place at least twice during the growing season to ensure that vegetation establishment by indigenous species is taking place appropriately.	Rehabilitation	4 years	Environmental officer	ECO (Bi-annually)	Control on invasive species before seeding	The number, cover abundance and size of alien species to be monitored, as well as area covered (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	All individuals responsible for alien control must receive appropriate training in the control of alien species.	Construction, Operation, Decommission & Rehabilitation	Annually	Environmental officer	ECO (Annually)	All workers responsible for control are appropriately trained.	Proof of training for all relevant personnel (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Ensure that species lists of the species to be controlled are available with clear photographs of the species to be controlled for easy identification. Indigenous species that are similar to the invasive species must not be confused with the invasive species.	Construction, Operation, Decommission & Rehabilitation	Annually	Environmental officer, Auditor	ECO (Annually)	Correct identification and control of invasive species	All documentation are in place (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
40. Weed Management Plan							
A	The Applicant, in consultation with the ECO, shall develop an appropriate weed management plan, to be implemented throughout the lifespan of the project. The weed management plan shall aim to eradicate and control alien vegetation in accordance with CARA. Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Specialist input shall be sought in developing the plan to ensure the potential for residual or latent impacts resulting from alien vegetation removal are minimised and mitigated. The weed						

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	management plan shall include appropriate measures for removal/control of alien vegetation across the entire site. The weed management plan shall include the following measures as a minimum; • Weeds and invader plants will be controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act or in terms of Working for Water guidelines, • Alien invasive tree species such as black wattle and blue gum should be eradicated, • Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented, • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds (including closure and post closure monitoring), The Plan must clearly define the areas from which alien vegetation must be removed as well as the plant, equipment, materials and methodology to be used (including safe disposal).						
B	Any action taken to control weeds or invader plants must be executed with caution and in a manner that will have minimal environmental impact. This is particularly important for any removal of alien species within riparian or wetland areas.						
C	Alien vegetation shall be disposed of in a responsible manner so as to prevent the potential for further dispersal or establishment. The method of disposal may vary for different species and shall be determined on a case by case basis by the ECO, who shall obtain advice from a suitably qualified expert if so required. Disposal methods to be considered may include; • Burning of the removed vegetation at an appropriate facility (burning shall not be permitted on the Mine property), • Disposal at a landfill site, Reuse of certain parts of alien vegetation may be considered but must be approved by the ECO (e.g. wood from alien trees used for firewood).						
D	The weed management plan take into account the potential for dispersal of alien vegetation (including dispersal resulting from disposal of alien vegetation). Appropriate measures to limit dispersal of alien vegetation must be included in the plan and may include, but will not be limited to the following; • If working within areas infested with alien invasive species, worker's boots and clothing, vehicles, drilling equipment and other plant/machinery/tools should be cleaned from mud, dust and other possible sources of seed/propagules before moving to other areas, in order to prevent the spread of alien invasive plant species. • Particular care must be taken to avoid the dispersal of alien seed/propagules into wetlands or aquatic ecosystems. • Proper disposal of cleared alien vegetation to prevent the further spread of alien invasive plant species. The ECO may advise on additional measures to prevent the further spread of alien invasive plant species.						
E	The use of herbicides should only be considered as a last resort if alternative methods are not feasible or practical. Application of herbicides shall only be undertaken by a suitably qualified individual in accordance with the relevant legislation and regulations. Herbicides shall only be administered by a registered Pest Control Operator (PCO).						
F	Follow up clearing may be necessary if the species re-establish following the initial clearing. Other alien species (non-listed) occurring on site may not be used in the landscaping and should be removed from site where possible.						

21.7 FAUNA

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-	Post-	FINAL Significance

			mitigation	mitigation	
Planning	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads (GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11) Establishment of firebreak Establishment of Eskom substation (GNR 544 Activity 10)	Loss of individuals of animal species of concern	-2.75	-1.75	-1.75
		Displacement of mobile fauna	-2.5	-2.5	-2.5
		Loss or fragmentation of habitat	-5.5	-5.5	-5.5
Operation	Mixing on concrete and concrete works Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Establishment of mobile office and ablution block Sewage and sanitation (GNR 544 Activity 55A; GNR 545 Activity 27; Category B Activity 4 and 5) Establishment of fuel storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of chemical storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of explosives storage area (GNR 544 Activity 13; GNR 545 Activity 3) Establishment of general and hazardous waste areas (Category C Activity 1 and 2) Drilling Blasting Excavations Removal of overburden by dozing and load haul	Degradation of habitat	-2.75	-2	-2
		Loss of individuals of animal species of concern	-2.75	-2.75	-2.75

	Establishment of internal haul roads (GNR 544 Activity 22 and 39) Waste rock dumps for backfilling Soil management Concurrent rehabilitation General site management Drilling Establishment of RoM stockpiles RoM stockpile transport Waste rock dumps for backfilling Soil management Water management Concurrent rehabilitation Water treatment (Category B Activity 4 and 5)				
Decommissioning	N/A	N/A	N/A	N/A	N/A
Rehabilitation & Closure	Slope stabilisation Erosion control Landscaping Replacing topsoil Removal of alien/invasive vegetation Re-vegetation Restoration of natural drainage patterns Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Creation of new habitats	6	6	6

FAUNA MANAGEMENT STRATEGY

The action plan for managing impacts on Fauna shall be accomplished through the development and implementation of a **Biodiversity Management Plan**. The Biodiversity management is based on the following principles:

- A biodiversity management plan may include individual species action plans as well as habitat or biodiversity feature action plans;
- A biodiversity management plan is characterised by a proactive and coordinated approach that directs, monitors and reviews the effective management of key biodiversity features of the land holdings of a particular land steward;
- A biodiversity management plan includes conservation projects, protection agreements and productive partnerships with stakeholders that deliver sound land use stewardship;
- A biodiversity management plan realizes the potential that responsible biodiversity management has to generate sustained economic benefits for local communities;
- Awareness program: raising awareness regarding biodiversity issues as part of an ongoing program to educate and train employees in the benefits of conserving biodiversity;
- Research: an important step in understanding and better managing biodiversity in and around the relevant land areas;
- Restoration and rehabilitation projects: aim to re-establish or supplement habitat that has been impacted upon, in order to assist in the re-colonization of endemic species.

The implementation plan and detailed technical management options below and in the Section 21.6 and the relevant specialist reports form the basis of the Biodiversity Management Plan. This must be finalised into a standalone plan that can be updated and amended as required.

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review

Planning	Obtain necessary permits for relocation	Pre-construction	Annual internal review	Environmental manager	ECO (once-off)
	Develop Search and Rescue Plan	Pre-construction	Annual internal review	Fauna specialist	ECO (once-off)
	Acquire offset habitat, if required	Pre-construction	Annual internal review	Environmental manager, input from specialist	Competent authority (once-off)
	Develop biodiversity management plan	1 month prior to construction	Annual internal review	Specialist	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Develop rehabilitation monitoring plan	Prior to construction	Annual internal review	Specialist	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Construction	Implement biodiversity management plan	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Monitor biodiversity management plan	Throughout construction	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Monitor biodiversity management plan	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Monitor biodiversity	Throughout decommissioning	Environmental Officer	ECO	Mine EO (Weekly)

	management plan		(weekly)	(Monthly audit)	ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Monitor biodiversity management plan	Throughout rehabilitation	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
41. Fauna							
F	On gaining access to the site, speed bumps must be incorporated into the design of the road network. This will reduce the speed of the vehicles and assist in the prevention of animal fatalities.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Where possible, conveyors should be constructed in such a way as to leave sufficient space for free movement of faunal species such as small mammals and herpetofauna.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	Signs shall be erected in areas where animal crossings may be prone.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent	Minimise and minimise impacts on biodiversity.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
		Rehab &Closure			Environmental Auditor (Annual)		(Annual Performance Assessment Reports)
42. Site Clearance							
A	Should any threatened or Red Data species be encountered on the site, in situ conservation is unlikely to be successful and it is recommended that a specialist be consulted for possible relocation.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No disturbance or harm to threatened or red data species.	(Contractor EO weekly checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
43. Sensitive Fauna							
B	The destruction of sensitive landscape features shall be avoided where possible and otherwise minimised through effective planning. In areas where the destruction cannot be avoided, these features should be re-introduced in the post mining landscape.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise destruction of habitat and minimise losses of biodiversity.	Observation that sensitive landscape features are avoided where possible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	Where possible infrastructure should be kept on already transformed areas such as cultivated fields, forestry stand and existing homesteads. Existing infrastructure should rather be upgraded and development kept together rather than developing new infrastructure away from existing infrastructure. Construction should be planned so that migratory corridors are not destroyed to allow for regional species viability.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise destruction of habitat, loss of biodiversity and fragmentation.	Verification that EMPR condition is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Infrastructure should be designed to rather follow the edge of natural areas than crossing it. If crossing it is the only option, then the area should be transected so that one large area remains rather than two equally sized	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise habitat loss and fragmentation.	Verification that EMPR condition is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	areas. Infrastructure should be condensed to prevent unnecessary sprawl into sensitive areas.						(Annual Performance Assessment Reports)
E	The staff of the mine should be educated/ informed about the risk that the introduction of foreign species have on the indigenous species. Abandoned homesteads should be monitored for the presence of domestic animals such as dogs and cats and appropriate control measures put in place. It is imperative that livestock remain isolated from the demarcated sensitive areas and that a “rotational” system of cattle camps be implemented depending on the grassland condition/trampling frequency to prohibit free-roaming of cattle.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No introduction of foreign species.	(Awareness training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Appropriate culverts should be implemented in order to facilitate movement of mammals throughout the site and limit fragmentation. All hillslope seeps areas, especially those that support contemporary as well as historical Broad-tailed Warbler and Grass Owl habitat should be adequately buffered.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Facilitate natural biodiversity corridors and minimise fragmentation.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	All staff and workers on site shall be informed of the no-go areas on site. Follow-up training should be conducted from time to time to reinforce the sensitivity and access restriction to these areas and disciplinary action should be taken against any person that does not comply with these restrictions.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No access or impact on demarcated sensitive areas/Visual observation that access to no-go areas is prevented. (Mine EO weekly checklist)	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	No construction workers or mine employees may disturb, hunt, set traps/snares, utilise dead or alive fauna/livestock/wildlife/fish. This	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent	Avoid and limit harm to fauna and flora.	Visual observation that no such prohibited activities occur on site. (Mine EO weekly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	includes the killing of any animal caught in construction works. No construction workers or mine employees may collect or remove firewood or medicinal plants or other plants/crops/fruits from the site or areas adjacent to the site. Disciplinary action must be taken in the event that any flora or fauna is wilfully disturbed or killed.				Environmental Auditor (Annual)		checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Any animals found within excavations should be carefully returned without harm to an adjacent area away from potential harm, but preferably not further than 200m away from where it was found.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Avoid impacts to fauna.	Return animals to suitable area. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
K	The contractor shall ensure that no snakes discovered in excavated areas, on or near the construction site are killed or otherwise harassed. The Mine EO must be notified should a snake be found on or near the site. The Mine EO will be responsible to ensure that an appropriately skilled person is summoned to remove the snake from the site for relocation to a suitable nearby location.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Safe removal and relocation of any snake discovered to a suitable nearby location.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

21.8 SURFACE WATER

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-	Post-	FINAL Significance

			mitigation	mitigation	
Planning	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of external haul roads GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11)	Erosion	-20	-4	-5.33
		Surface water contamination	-9	-4.5	-4.5
		Deterioration of river banks	-9.75	-5.5	-6.42
		Loss of vegetative cover	-13.75	-5	-6.67
		Stream flow reduction	-7.5	-4.5	-6.75
		Soil compaction	9	7.5	10
		Sediment run off and increased suspended solids	-15	-4.5	-6
		Altered drainage pattern	-9	-3	-3
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Sewage and sanitation (GNR 544 Activity 55A; GNR 545 Activity 27; Category B Activity 4 and 5) General site management Excavations Establishment of internal haul roads (GNR 544 Activity 22 and 39) Pumping of water to PCD's (GNR 544 Activity 9) Water management (Category B Activity 4 and 5) Concurrent rehabilitation Water treatment	Erosion	-18.75	-6.75	-9
		Surface water contamination	-7.5	-7.5	-8.75
		Deterioration of river banks	-9	-5	-6.67
		Stream flow reduction	-9	-5.5	-7.33
		Soil compaction	9	4	4.67
		Sediment run off and increased suspended solids	-6.5	-6.75	-9
		Altered drainage pattern	-16.25	-4.5	-5.25
Decommissioning	Dismantling and demolition of infrastructure	Erosion	-17.5	-4	-5.33
		Surface water contamination	-13	-9	-10.5
		Deterioration of river banks	-16	-5	-5.83
		Stream flow reduction	-9	-5.5	-7.33
		Soil compaction	8.25	5	6.67
		Sediment run off and increased suspended	-9.75	-5	-7.5

		solids			
		Altered drainage pattern	-5	-3	-4
Rehabilitation & Closure	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns Remediation of ground and surface water Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Erosion	-16.25	-6	-8
		Surface water contamination	-9.75	-9	-10.5
		Stream flow reduction	-10	-5.5	-8.25
		Soil compaction	9.75	-6.75	-11.25
		Sediment run off and increased suspended solids	-14	-6	-10
		Altered drainage pattern	-6.5	-4	-5.33

SURFACE WATER MANAGEMENT STRATEGY

The general principle of water management is the recognition that is a scarce resource. This principal is guided by water use minimisation (water conservation) or re-use of water and pollution prevention or the limitation of pollution of water.

The goal of the Leiden Coal Mine is to minimise water consumption, impacts to the environment, running costs and to achieve environmental legal compliance whilst maintaining adequate water supply as not to compromise the mining operations and supply of coal to industry. The following objectives are therefore set for the project:

- Water conservation by minimising water use. Water is reused wherever possible;
- Prevention of water pollution where possible;
- Minimise impacts on water resources and receiving water environment;
- Achieve and maintain legal compliance;
- Continuous mining operation to supply market need; and
- Production of quality coal for industry.

In order to achieve the above objectives, the mine is committed to uphold the following broad commitments:

- All water that can remain unpolluted will be kept separate and dirty water areas will be minimised;
- The use of water resources for processing and mining activities will constantly be evaluated to ensure that their use is optimised;
- No water will be discharged unless authorised by the DWA especially water that exceeds the catchments water quality objectives, as set out by the National Authority, with the exception of emergency conditions if safety should demand so;
- Dirty water catchments will be minimised and kept separate from clean catchments and all water contained here shall be re-used as far as possible, thus reducing the quality or raw water extracted;
- All the relevant principles contained in DWA's Best Practice Guidelines (BPG) will be utilised to guide mine design and management practices. The mine will also ensure compliance with GN 704 of the National Water Act.

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review
Planning	Finalise Surface water Monitoring Plan	Prior to construction	Annual internal review	Applicant	Environmental Manager (annual internal review) ECO (External review as required)
Construction	Implement the storm water management plan as per EMP	During site establishment	Annual internal review	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental

					Auditor (Annual)
	Implement Surface water Monitoring Plan	Throughout construction	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Update the mine water balance every three years	Every three years	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement Surface water Monitoring Plan	Throughout operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement Surface water Monitoring Plan	Throughout decommissioning	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Implement Surface water Monitoring Plan	Throughout Rehabilitation	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical	Throughout rehabilitation	Environmental Officer	Applicant	Mine EO (Weekly) ECO

	management measures as per EMP		(weekly)		(Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
44. Surface Water, Storm Water and Erosion Control							
A	The detailed storm water management plan must be approved and implemented as soon as possible during the construction phase. Clean and dirty water system infrastructure must be installed as per the detailed storm water management plan which must take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Separation of clean and dirty water sources. Minimise impacts on watercourses.	Observation that appropriate mitigation measures are implemented. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The approved Storm Water Management Plan shall comply with the relevant regulatory requirements and standards and shall make provision for the following as a minimum: • Clean and dirty water shall always be separated; • Clean and dirty water system infrastructure must allow for clean water to re-enter the receiving environment and dirty water to be contained in PCD's; • Dirty water dams (e.g PCD's) must be lined to prevent potential contamination of ground and/or surface water resources. All dams must be equipped with an appropriate silt trap that is regularly cleaned and maintained; • The Storm water management system shall be designed so as to limit ponding of water to limit	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Separation of clean and dirty water sources. Minimise impacts on watercourses.	Verification that storm water system is functioning as required. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	infiltration; • Construction and maintenance features of the storm water system and dirty water infrastructure shall be designed in such a way as to prevent accidental spillages; • All waste and mine matter must be removed or contained; • All surplus water is to be re-used on site as mine service water; • Silt traps will be maintained and will only be removed at the end of rehabilitation.						
C	Where clean water is diverted away from construction and/or mining areas, its point of re-entry into the natural watercourse should be well protected against erosion. In addition, sediments should be effectively trapped before re-entry.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Avoid erosion, scouring and siltation of watercourses.	Verification that adequate erosion and silt control measures have been implanted at discharge points. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	No wastewater may run freely into any of the surrounding environment or neighbouring properties. The contractor shall implement the storm water design in accordance with the approved Storm Water Management Plan. The Applicant and Contractor(s) shall ensure compliance with the requirements of the National Water Act and GN704.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No polluted runoff from site.	Visual observation that stormwater is contained and managed, i.e. no rill or gulley formation. Visual observation that erosion control measures are effective. (GN704 audits) (Water monitoring reports) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	All areas susceptible to erosion shall be protected by ensuring that there is no undue soil erosion resultant from construction and/or mining activities. Berms shall be constructed where necessary to direct all runoff into the	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor	Prevent erosion and scouring.	Implement effective storm water and erosion control measures. (Mine EO weekly checklist)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	stormwater system. Care must be taken to avoid scouring and erosion and suitable measures should be placed in areas where runoff concentrates, in order to detain the sediment load and slow down the runoff. All erosion damage shall be repaired as soon as possible as directed by the ECO.				(Annual)		(ECO Monthly Checklist/Report)
F	The disturbance of steep slopes, for example by the removal of vegetation, may result in slope instability and erosion by rain and surface runoff. All slopes that are disturbed during construction shall immediately be stabilised to prevent erosion.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise potential for erosion.	Visual inspection of slopes for compliance with EMPR requirements and signs of erosion. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	All storm water and erosion control mechanisms must be inspected frequently and shall be maintained on a regular basis to ensure they remain effective. Appropriate remedial action, including the rehabilitation of eroded areas, shall be undertaken under direction from the ECO.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Maintain storm water & erosion control measures to ensure erosion is effectively mitigated.	Visual observation that measures are maintained and remain effective. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	Upon rehabilitation, the surface and slopes of the land must be rehabilitated to a free draining state, except in areas where water may enter the open adit where measures shall be implemented to prevent surface water entering the underground workings.	Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise potential for erosion.	Visual inspection of slopes for compliance with EMPR requirements and signs of erosion. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	The Applicant shall continue to investigate various water treatment options including pH adjustment, controlled release and further containment options.	Construction Operation Decommissioning Rehab &Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly)	Effective treatment of polluted water	Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
							(ECO Monthly Checklist/Report)
J	There should be ongoing review and implementation of best available technology to mitigate and treat AMD where appropriate and feasible as per Section 21.4.	Operation Decommissioning Rehab &Closure	Upon completion of decommissioning	Applicant	Mine EO (Weekly) ECO (Monthly)	Effective treatment of polluted water	Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
45. Guide to Installing Erosion and Siltation Management Measures							
A	These are made up of Bidim™ and /or shade cloth held in place with poles every 1 meter (maximum) apart. The Bidim should be placed against the y-poles and an extra length of about 1 meter should lie on the bottom of the stream facing upstream to ensure no sediment can escape underneath the wall. The height of the Bidim walls should be 10cm above the water level. These walls must cover the whole breadth of the gully and should not allow any water through that has not passed through the Bidim wall. These sediment barriers must be inspected every week to ensure they are still functioning. If a build-up of sediment occurs then the sediment must be removed. If the barriers are washed away by a flood or damaged in any way the replacement should occur as soon as possible.						
B	These should be placed horizontal to the flow direction and should cover the whole length of the slope or preferential flow path. Firstly a trench about 20cm (about half the height of the fibre roll) should be made in the flow path fibre roll placed in the trench. The trench should then be filled around the roll and compacted- using hand tools. The roll should then be permanently attached to the gully using wooden stakes leaving no more than 50mm of the stake protruding from the top of the roll. If high flow volumes are expected a double stake should be placed on both sides of the roll. These two stakes should then be tied together using wire and pulled taught.						
C	These should be placed in their length across areas where erosion gulleys have formed. Excavation of soil should be done to a depth half that of the bales. The bales should then be placed in the trench and secured using stakes. If any of the bales being used disintegrates it should be replaced. Broken bales will break up even further once in free flowing water. Surrounding soil needs to be replaced and compacted using hand tools.						
D	The stakes should all preferably be made from treated wood. The standard length of the stakes should be 800mm long and 40mm wide to ensure a wide variety of applications. To ensure the stakes are properly used they should all be installed a minimum of 500mm below the surface. Any protrusions above any structures should not exceed 50mm.						
E	Netting should be used that allows 60% of the surface to be open to allow for the germination of seeds through the netting. These nets come in widths of 1.3 and 1.5 meters. These should be anchored to the bank walls with wooden stakes 1.5-2 meters apart. The hessian should also be applied vertically. The hessian should not be placed as far as the bottom or aquatic zone but should still reach the fibre rolls. Before the installation of the hessian, proper soil preparation by hand using a hoe must be done to ensure the proper seed beds are formed.						

21.9 WETLANDS AND AQUATIC ECOLOGY

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	**ACTIVITY**	**IMPACT**	**SIGNIFICANCE**		
			Pre-	**Post-**	**FINAL Significance**

			mitigation	mitigation	
Planning		Increased sedimentation at wetland crossings	-3.75	-3.75	-3.75
Construction	Vegetation clearance Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of external haul roads (GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11)	Disturbance of wetland habitat	-7.5	-1.75	-2.92
		Increased sediment transport into wetlands	-8	-3.5	-4.08
		Water quality deterioration	-6	-3.5	-4.67
		Decreased watermake to adjacent wetlands	-13.75	-12.5	-16.67
		Sedimentation	-12	-11	-11
		Erosion at river crossings	-17.5	-17.5	-20.48
		Flow modification	-11	-10	-10
		Erosion of banks and channel incision	-16.25	-11	-12.87
		Water quality	-12	-7.5	-8.78
		Spread of alien fish species	-12	-7.5	-8.78
		Alien invasive vegetation	-12	-7.5	-8.78
		Loss of sensitive species	-8.25	-5.5	-7.32
Operation	Establishment of infrastructure and services (Activity 545 Activity 15) Mixing on concrete and concrete works Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Sewage and sanitation (GNR 544 Activity 55A; GNR 545 Activity 27; Category B Activity 4 and 5) General site management Excavations Establishment of internal haul roads (GNR 544 Activity 22 and 39) Pumping of water to PCD's (GNR 544 Activity 9) Water management Concurrent rehabilitation Water treatment (Category B Activity 4 and 5)	Disturbance of wetland habitat	-4.5	-1.75	-2.92
		Increased sediment transport into wetlands	-8	-3.5	-4.08
		Water quality deterioration	-7.5	-6	-8
		Decreased watermake to adjacent wetlands	-13.75	-11.25	-15
		Discharge of storm water into wetlands	-9	-6	-8
		Undermining of wetlands – surface subsidence	-7.5	-3.25	-4.33
		Deterioration of water quality from coal	-14	-13	-19.5
		Acidification and salinization of surface water	-22.5	-21.25	-38.89
		Water pollution/contamination from spills/leaks	-21.25	-16	-26.72
		Deterioration in water quality and habitats	-15	-7.5	-8.78
		Deterioration of water quality from runoff	-15	-7.5	-8.78
		Deterioration of water quality and habitat from coal transport	-14	-14	-16.38
		Water pollution/contamination from major spills	-14.25	-8.5	-14.19
		Flow modification	-12.75	-8	-13.36
		Increased storm water	-13	-11	-11
		Sedimentation of habitats	-12	-10	-10
		Bank destabilisation and erosion due to blasting	-8.25	-8.25	-8.25

		Invasive alien vegetation	-13	-10	-11.7
		Impacts on fish migration and distribution	-15	-9	-11.97
		Loss of sensitive species and biodiversity decline	-25	-21.25	-31.88
		Cumulative impacts	-25	-22.5	-41.18
Decommissioning	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns	Increased alien vegetation cover	-9	-5.25	-5.25
		Water quality deterioration	-7.5	-6	-8
		Increased sediment transport into wetlands	-6	-5.25	-6.13
		Deterioration in water quality and habitats	-13.75	-6	-6
		AMD and seepage	-21.25	-21.25	-38.89
		Increased sedimentation	-12	-10	-10
		Water pollution/contamination from spills/leaks	-21.25	-16	-26.72
		Invasive alien vegetation	-13	-10	-13.3
		Water pollution/contamination from major spills	-19	-8.5	-14.19
		Loss of sensitive species and decline in biotic integrity	-19	-18	-23.94
Rehabilitation & Closure	Remediation of ground and surface water Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Increased sediment transport into wetlands	-8	-3.5	-4.08
		Altered hydrology	-10	-7.5	-10
		Water quality deterioration	-21.25	-10	-13.33
		Surface subsidence	-7.5	-3.5	-4.67
		AMD and decant	-25	-21.25	-41.01
		Decrease in water quantity	-21.25	-11.25	-18.79
		Sedimentation and erosion	-12	-10	-10
		Invasive alien vegetation	-13	-10	-11.7
		Deterioration of water quality	-11	-6	-6
		Biodiversity loss and decline in biotic integrity	-25	-22.5	-33.75
		Cumulative impacts	-25	-22.5	-37.58

WETLAND AND AQUATIC ECOLOGY MANAGEMENT STRATEGY

Management actions should consider that the main impacts of the development are likely to be to water quality, as well as water quantity (flows) within receiving watercourses. As such, the main objectives for management are:

- To take all reasonable measures to prevent any disturbance, damage or impact to aquatic ecosystems outside of mining footprint
- Minimise and prevent disturbance to wetlands and watercourses
- Prevent impacts to water quality
- Prevent and minimise erosion and sedimentation
- Prevent flow changes in receiving watercourses

- Considering the potential for some permanent loss of aquatic ecosystems habitat, it is strongly recommended that biodiversity offset measures are considered, preferably by formally protecting intact systems with similar ecosystem components
- Effective bio-monitoring programme be implemented as soon as possible to assess and mitigate negative impacts on aquatic ecosystems
- Manage biodiversity
- Rehabilitate

IMPLEMENTATION PLAN					
Phase	**Management Action**	**Timeframe for Implementation**	**Review/Repeat frequency**	**Responsible Party For Implementation**	**Responsible Party For Monitoring and Review**
Planning	Appoint aquatic ecology specialist to assist in the development of a biomonitoring plan	1 month prior to construction	Once-off	Applicant	Independent Environmental Auditor (Annual)
Construction	Periodic monitoring as per biodiversity, surface water and aquatic health monitoring plans	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement aquatic ecology monitoring programme	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Delineate and demarcate wetlands within 100 m of development footprint as no go areas.	Once-off	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Periodic monitoring as per biodiversity, surface water and aquatic health monitoring plans	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

Decommissioning	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Periodic monitoring as per biodiversity, surface water and aquatic health monitoring plans	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Periodic monitoring as per biodiversity, surface water and aquatic health monitoring plans	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
46. Wetlands							
A	All pollution dams will be lined and contained in the dirty water area.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise damage to wetlands and aquatic ecology.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	Clean water must be diverted around the co-disposal facility and return water dams and released in to the down-slope wetlands along the full	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent	Separation of clean and dirty water sources. Minimise impacts on watercourses.	Observation that appropriate mitigation measures are implemented. (GN704 Audits) (Mine EO

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	width and at velocities not significantly exceeding those flows within the wetland.				Environmental Auditor (Annual)		weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	Limit the extent of the development footprint to exclude aquatic resources as far as possible.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise damage to wetlands and aquatic ecology.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Take the necessary precautions to avoid any impacts to wetlands outside of the required construction and/or mining footprint. These areas should be considered as no-go areas, and the restriction should be enforced.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise damage to wetlands and aquatic ecology.	No damage to wetlands outside of required development footprint. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Where construction and/or mining is required within wetland areas, the contractor shall ensure that the limits of the activities are clearly demarcated prior to the onset of construction/mining in these areas so as to avoid unnecessary direct impacts to the vegetation beyond the limits of construction/mining.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise damage to wetlands and aquatic ecology.	Visual inspection to confirm that development/mining areas are clearly demarcated. No damage to vegetation beyond limits of construction/mining. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	Any wetlands impacted during the construction process on site should be rehabilitated in accordance with the principles and guidelines presented in this EMPR.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent	Minimise damage to wetlands and aquatic ecology.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands.

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
					Environmental Auditor (Annual)		(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Re-vegetate all bare wetland areas not directly within the footprint of the developments as soon as possible. The extent of the disturbance should be limited to a minimum.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Effective rehabilitation of wetlands.	Visual inspection to confirm that rehabilitation efforts are adequate. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	A shallow berm should be constructed between the proposed opencast footprint and the downslope wetlands to prevent sediment rich runoff from excavated areas entering the wetlands. These berms should thus be constructed prior to the commencement of excavating the opencast pit.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise sedimentation of wetlands.	Observation that berm has been constructed. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	Implement an aquatic bio-monitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.	Planning Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Monitor potential impacts on aquatic ecology.	Verification that bio-monitoring program is implemented. (Bio-monitoring reports) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Prohibit the stocking of any alien fish species into dams or streams within the mining area. If alien fish species are present or observed within the mining area, they should be removed.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent spread of alien fish species and impacts on indigenous fish populations.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
K	Should fish from the dams within the mining area be utilised as a food source, a Human Health Risk Assessment must first be done to ensure that the fish is safe for human consumption. Until such studies have been conducted, consumption of such fish should be avoided.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent health impacts arising from consumption of fish that may be exposed to contamination.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
L	Construction of a low berm, approximately 1m high by 2-3m wide between the stockpiles and the wetlands. These berms would serve to intercept flows containing suspended sediments and create a depositional environment. They should be located outside the wetland boundaries and should be created prior to construction and vegetation clearing on the stockpile footprint commencing.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise damage to wetlands and aquatic ecology.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
M	No dirty water may be discharged into any wetland or water resource on site unless treated to the required standards.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise damage to wetlands and aquatic ecology.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
N	Regular monitoring of the success of wetland rehabilitation measures must be undertaken. Where required, the necessary adjustments should be made to ensure the complete re-establishment of the natural vegetation.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure successful rehabilitation of wetlands is undertaken.	Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
O	All wetland areas located adjacent to mining areas must be demarcated prior to commencement of vegetation clearing activities on site so as to	Planning Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	No disturbance to wetland areas or their buffer zones	No tyre tracks, soil disturbance, soil compaction, stockpiles or solid waste in wetland

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	prevent access to construction machinery and personnel. In addition, all wetland areas should be clearly marked and demarcated as such to alert construction staff on site. All construction staff should also be educated on the importance and sensitivity of the wetland systems on site. This should form part of the induction process	Decommissioning Closure and Rehab			ECO (Monthly) Independent Environmental Auditor (Annual)		areas Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
P	No stockpiling of material may take place within the wetland areas and temporary construction camps and infrastructure should also be located away from these areas, with a minimum buffer of 100m maintained from delineated wetland boundaries.	Construction, Operational	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No additional transport of sediments in watercourses downstream of Leiden	No increase in turbidity or sedimentation in the Hlelo and Ngwempisi Rivers (\Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
Q	Ensure that no equipment is washed in the streams and wetlands of the area, and if washing facilities are provided, that these are placed no closer than 50m from a wetland or water course.	Construction, Operational	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No disturbance to wetland areas or their buffer zones	No tyre tracks, soil disturbance, soil compaction, stockpiles or solid waste in wetland areas Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
R	No abstraction of water from the wetlands or dams should be allowed unless expressly authorized in the IWULA.	Ongoing	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental	No disturbance to wetland areas or their buffer zones	No tyre tracks, soil disturbance, soil compaction, stockpiles or solid waste in wetland areas Verification that monitoring and corrective

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
					Auditor (Annual)		actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
S	No runoff from the construction/infrastructure site should be introduced into wetlands directly. Introduction into dryland areas is preferred as the vegetation and soils provide an opportunity to limit the movement of contaminants and the environment is conducive for natural degradation.	Construction, Operational	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No decline in water quality from storm water runoff	No water quality declines downstream of Leiden Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
T	Water quality and biomonitoring plans should be implemented to monitor for water quality deterioration downslope of any dirty water areas, carbonaceous stockpiles, PCD's or any other potentially polluting activity.	Construction, Operational, Decommissioning, Closure	Commencing during construction	Applicant Contractor Aquatic specialist	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No loss of sensitive species, no decline in biotic integrity by more than one category. pH and EC within guideline limits for aquatic ecosystems. No toxic hazard within downstream wetlands (see Section 14).	No loss of sensitive species, no decline in biotic integrity by more than one category. pH and EC within guideline limits for aquatic ecosystems Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
U	Where storm water and/or diverted clean water is discharged into wetlands, gabions should be constructed to contain erosion.	Construction, Operational, Decommissioning, Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No erosion at stormwater outlets	No erosion at stormwater outlets (monitoring inspections)
V	Surface subsidence must be avoided. As a minimum, it is recommended that	Operational, Decommissioning,	Ongoing	Applicant Contractor	Contractors EO (Daily)	No surface subsidence within wetlands or within	No surface subsidence within wetlands or within

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	no subsidence be allowed to take place within delineated wetland areas and within a 100m buffer zone surrounding the wetlands.	Closure			Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	100m of wetlands.	100m of wetlands Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
47. Wetland Rehabilitation Guidelines (from the Wetland EIA Report – see Appendix G)							
Addressing Soil Compaction	Soil compaction should be alleviated through ploughing/ripping and scarifying, followed by landscaping to the natural/surrounding landscape profile. Where ploughing/ripping takes place on slopes leading towards wetland areas or water courses, sediment barriers (see below) should be installed along the lower edge of the ploughed area.						
Re-vegetation	Once soil preparation is complete, seed beds should be prepared as follows: Furrows should be made in the soil by hand using hoes. Furrows must be made horizontally in the soil (parallel to slope) and should be spaced 0.4 meters (maximum) apart and at least 10 cm deep. Work should commence from the top of the slope and be conducted downwards and any loose soil and rocks from the process should be removed to prevent siltation of the wetlands downwards. The beds should follow the contours of the land and not in any way allow water to collect or flow in high volumes, thus creating erosion gullies. Larger clumps of soil and stones should be removed to prevent impeded flow of water. On steep slopes and high erosion risk areas the use of hessian blankets is recommended to increase erosion protection.						
	Seeding should commence as soon as the hessian is in place and seed bed preparation has been completed. Either hand or hydro-seeding can be considered, depending on the area required to be planted. Both hand and hydro-seeding must be done by professionals only. If any fertilizers are recommended these should be applied to the side slopes only and not within the wetland. If hydro seeding is selected for the seeding process the hydro-seeders used must run for 10 minutes at least before the commencement of the seeding project. This is to ensure adequate mixing of the seed and water. Water extraction for the hydro-seeding from the wetlands and pans is not allowed unless authorization is received from the Department of Water Affairs. A good rehabilitation grass mix can be obtained from Advanced-seed or African grass seeds, but must contain indigenous grass species which are conspicuous in the Highveld grassland. Once the initial rehabilitation has been completed the rehabilitated areas should be checked for erosion at the end of the first summer. If erosion is observed, appropriate action should be taken to limit its extent.						
Alien Vegetation Control	Alien plants are likely to colonise the areas disturbed during the construction/decommissioning process. Areas disturbed during the construction process should be checked on a 6 monthly basis and any undesirable plants encountered in the areas immediately upstream and downstream of the rehabilitated areas should be removed, ideally by hand so as to reduce the risk of herbicides being transferred further into the wetlands.						
	The removal of Category 1, 2 and 3 Declared Weeds is compulsory in terms of the regulations formulated under "The Conservation of Agricultural Resources Act" (Act No. 43 of 1983).						
	Exotic plantations should be checked for breeding owls and breeding raptors. If there are any, then these trees should be left as is, if at all possible.						
48. Aquatic Ecology							
A	As a general rule, any areas which are disturbed must be re-vegetated as soon as possible following disturbance.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Limit potential for impacts to water resources.	Confirmation that development and infrastructure is appropriately located.

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
					Independent Environmental Auditor (Annual)		(GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The Applicant shall ensure that riparian zones near to the site are delineated prior to the start of the construction phase and these shall be no-go areas.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit potential for impacts to water resources.	Confirmation that development and infrastructure is appropriately located. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The Applicant and contractor(s) shall take all reasonable measures to avoid riparian zones and shall thereby ensure that riparian zones are kept intact.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise potential for erosion.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities and no access inside riparian zones. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Construction activities should take place in winter as far as possible.	Construction	Construction	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit potential for impacts to water resources.	Confirmation that development and infrastructure is appropriately located. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
							Assessment Reports)
E	Runoff from the stockpiles and from washbays and workshops should be captured in the dirty water system. No dirty water may be discharged into any wetland or water resource on site unless treated to the required standards.	Construction, Operational, Decommissioning, Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit potential for impacts to water resources.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	No water, including stormwater, should be discharged directly into wetland areas without attenuation and sediment trapping. Limit vegetation clearing to the actual footprint of the proposed development. Revegetate all bare areas to facilitate infiltration and also to facilitate sediment trapping.	Construction, Operational, Decommissioning, Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise potential for erosion.	Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Stormwater management, including pollution control dams and stormwater trenches, should be designed according to DWAF Best Practice Guidelines (2006, 2007a, b, 2008). Infrastructure associated with dirty water (stormwater trenches and dams, stockpiles) should be lined with an appropriate impermeable layer (based on the waste classification) and should cater for the >1:50 year storm events.	Planning, Construction	By operational phase	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No seepage or leaks from PCDs and stockpiles	No water quality declines downstream of Leiden Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	All clean water should be returned to natural wetland areas in an attenuated manner.	Construction, Operational, Decommissioning, Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental	No decline in the volumes, velocities and seasonal variation of flows in Hlelo Tributaries.	No change in the volumes and velocities of flows in Hlelo Tributaries (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
					Auditor (Annual)		Checklist/Report) (Annual Performance Assessment Reports)
I	All discharges into wetlands should comply with flow requirements of the receiving watercourse, as advised by DWA. Clean stormwater discharges into natural watercourses need to be attenuated to the required extent with flow attenuating structures. All clean stormwater must be returned to the natural watercourses in this manner.	Construction, Operational, Decommissioning, Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Legal compliance, No increase or decrease in the volumes, velocities and seasonal cycles of flows in Hlelo Tributaries. No erosion at or downstream of discharge points.	Legal compliance, No increase or decrease in the volumes, velocities and seasonal cycles of flows in Hlelo Tributaries. No erosion at or downstream of discharge points. Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	No water should be released unless it is deemed clean according to DWA stipulations and meets the water quality requirements of the downstream ecosystems (as advised by DWA). Target water quality criteria should be set for receiving watercourses and all releases should comply with these. Additional assessments may be requested by DWA to set target values	Planning Construction, Operational, Decommissioning, Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	No decline in water quality in receiving watercourses (water quality monitoring)	No decline in water quality in receiving watercourses (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

21.10 GROUND WATER

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Planning	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of external haul roads GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11)	Clearing topsoil for footprint areas	-7.5	-7.5	-7.5
		Hydrocarbon contamination of groundwater	-4.5	-3.75	-3.75
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Sewage and sanitation (GNR 544 Activity 55A; GNR 545 Activity 27; Category B Activity 4 and 5) General site management Excavations Establishment of internal haul roads (GNR 544 Activity 22 and 39) Pumping of water to PCD's (GNR 544 Activity 9) Water management (Category B Activity 4 and 5) Concurrent rehabilitation Water treatment (Category B Activity 4 and 5)	Dewatering	-15	-15	-17.5
		Reduction in stream baseflow	-9.75	-9.75	-11.38
		AMD contamination of ground water	-7.5	-7.5	-8.75
		Hydrocarbon contamination of ground water	-4.5	-3.75	-3.75
Decommissioning	N/A	N/A	N/A	N/A	N/A
Rehabilitation & Closure	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns	Ground water contaminant plume	-13	-12	-16
		Contaminated ground water seepage to surface water	-15	-15	-20

		Decant from underground	-21.25	-18.75	-37.5
GROUND WATER MANAGEMENT STRATEGY					
The ground water management strategy is in line with the principles outlined for the management of surface water resources and for the management of AMD. Please refer to sections 21.4 and 21.8 for detail.					
IMPLEMENTATION PLAN					
Phase	**Management Action**	**Timeframe for Implementation**	**Review/Repeat frequency**	**Responsible Party For Implementation**	**Responsible Party For Monitoring and Review**
Planning	Develop Ground water Monitoring Plan	Prior to construction	Annual internal review	Applicant	Environmental Manager (annual internal review) ECO (External review as required)
Construction	Implement Surface and Ground water Monitoring Plan	Throughout construction	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement Surface and Ground water Monitoring Plan	Throughout operation	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement Surface and Ground water Monitoring Plan	Throughout decommissioning	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

Rehabilitation	Implement Surface and Ground water Monitoring Plan	Throughout Rehabilitation	ongoing	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
49. Ground Water Pollution							
A	The Applicant shall ensure that all dirty water facilities and carbonaceous discard facilities are properly lined according to best industry practise. The Applicant shall ensure that proper protection of the lining is undertaken.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Separation of clean and dirty water sources. Minimise impacts on watercourses.	Observation that appropriate mitigation measures are implemented. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The Applicant shall ensure that lining of dams is undertaken before any storage activities occurs to reduce seepage. Dam levels should be kept at the required levels (refer to GNR704).	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Separation of clean and dirty water sources. Minimise impacts on watercourses.	Observation that appropriate mitigation measures are implemented. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The Applicant shall ensure that the ground water monitoring program is implemented. All boreholes shall be monitoring throughout the LOM for ground water level and quality.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor	Avoid and limit pollution of ground water.	Verification that EMPR mitigation measures are implemented to avoid and limit ground water pollution.

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
					(Annual)		(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Coal discard must be compacted and cladded to reduce rainfall infiltration. The coal discards shall also be properly lined to avoid seepage into the underlying strata.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Separation of clean and dirty water sources. Minimise impacts on watercourses.	Observation that appropriate mitigation measures are implemented. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	The mine must take all reasonable measures to avoid and limit pollution of ground water resources as a result of site activities. Pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, waste water containing organic waste, detergents, solid waste and litter etc. The Applicant and Contractor(s) shall comply with the requirements relating to hazardous materials and spill management presented in this EMPR.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Avoid and limit pollution of ground water.	Verification that EMPR mitigation measures are implemented to avoid and limit ground water pollution. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	In the event of pollution caused as a result of construction or mining activities, the responsible party, according to section 20 of the National Water Act (Act No. 36 of 1998) shall be responsible for all costs incurred by organisations called to assist in pollution control and/or to clean up polluted areas.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Compliance with NEMA and polluter pays principle	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

21.11 AIR QUALITY

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Planning	Pre-commencement survey	Dust nuisance	-6	-6	-9
Construction	Vegetation clearance Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads(GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11)	Dust nuisance	-12	-5	-7.5
Operation	Establishment of infrastructure and services Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Drilling Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads (GNR 544 Activity 22 and 39) Removal of ore Establishment of RoM stockpiles Blasting Safety control	Dust nuisance	-16	-7.5	-11.25
Decommissioning	Concurrent rehabilitation Dismantling and demolition of infrastructure Backfilling of pits and voids Slope stabilisation	Dust nuisance	-13	-5.5	-8.25
Rehabilitation & Closure	Rehabilitation of external roads Erosion control Landscaping	Dust nuisance	-12	-5.5	-7.33

	Replacing topsoil				

AIR QUALITY MANAGEMENT STRATEGY

The **air quality management strategy** is based on the following principles:

- Open and transparent communication with the public and IAP's about air quality and raising awareness;
- Mitigation of emissions, especially from unpaved roads to lower impacts to more acceptable levels;
- Mitigation of particulate emissions at handling points and during crushing operations should also be considered;
- Development/validation of management tools such as models and inventories;
- Compliance with national and international standards;
- Effective monitoring of ambient air quality, including nuisance dust-fall and PM_{10};
- Providing objective inputs to management;
- Data interpretation and trending to identify future problems or progress against management actions;
- Integration into mines grievance mechanism for communities to lodge concerns, suggestions and complaints with respect to dust which can be dealt with by the Project in a timely manner.

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review
Planning	Finalise air quality monitoring programme	1 month prior to construction	Annual internal review	Applicant	Environmental Manager (annual internal review) ECO (External review as required)
Construction	Implement air quality monitoring programme	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement air quality monitoring programme	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement air quality	Throughout decommissioning	Environmental Officer	ECO	Mine EO (Weekly)

	monitoring programme		(weekly)	(Monthly audit)	ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Implement air quality monitoring programme	Throughout rehabilitation	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
50. Air Quality							
A	The drop height at the off-load point will be limited or it will be closed off in order to reduce the amount of fugitive dust emissions.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent dust pollution or nuisance to sensitive receptors.	Visual observation that dust creation is limited as far as possible. (Dust Monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	Every effort should be made to avoid the tracking of coal from the site onto the road as this can have the impact of increasing the dust impact of the roads and changing the profile of the dust to one of black coal dust. The ECO shall	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental	Prevent dust pollution or nuisance to sensitive receptors.	Visual observation that dust suppression is done effectively. (Dust Monitoring) (Mine EO weekly checklist) (ECO Monthly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	evaluate the condition of the roads and in the event that coal dust is being tracked off site to an unacceptable degree, the Applicant shall implement measures as necessary to avoid and reduce this impact. To this end, wheel wash pans should be considered to prevent tracking of coal off site.				Auditor (Annual)		Checklist/Report) (Annual Performance Assessment Reports)
C	It is important to note that dust could be a major disturbance, especially during the dry winter periods to people residing around the site. All reasonable measures must be utilised to minimise the generation of dust as a result of activities on site. Such measures shall include, but shall not be limited to; • Measures aimed at reducing the extent of unpaved roads, e.g. surfacing roads • Traffic control measures aimed at reducing the entrainment of material by restricting traffic volumes and reducing vehicle speeds; • Regular and effective measures aimed at binding the surface material or enhancing moisture retention, such as wet suppression and chemical stabilisation; • Application of chemical dust palliatives and the optimal selection of wearing course materials (where possible environmentally friendly products should be utilised); • Appropriate scheduling of dust-generating activities (e.g. the clearing of parking areas should be postponed until the construction	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent dust pollution or nuisance to sensitive receptors.	Visual observation that dust suppression is done effectively. (Dust Monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	programme requires the clearing of that specific area). • Avoid excavation and stockpiling activities during periods of strong winds. • Increase dust suppression efforts during conditions conducive to excessive dust creation (e.g. dry and windy conditions). • Limit the height of soil stockpiles where possible, and wetting down of soil stockpiles when excessive dust is generated from these stockpiles; and • Areas where excessive or difficult to manage fallout dust and erosion occur remain may be treated with chemical dust suppressant or paved as opposed to using water.						
D	The Applicant/Contractor(s) shall comply with the National Dust Control Regulations, Promulgated under the National Environmental Management: Air Quality Act (Act 39 of 2004).	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Compliance with dust regulations.	(Dust Monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	In the event that dust levels exceed the specified thresholds in terms of the dust control regulations, the Applicant shall appoint a suitably qualified specialist to identify sources of the excessive dust levels and to suggest suitable and reasonable mitigation measures.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit the potential for dust pollution or dust nuisance.	Confirmation that dust levels do not exceed specified thresholds. (Complaints register) (Dust monitoring) (Safety Reports) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	Any water used for dust suppression must be obtained from a legal source in accordance with relevant legislation and regulations. The amount of water	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	Ensure sustainable and legal water use.	Confirmation that water use complies with conditions of relevant

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	used for dust suppression shall be recorded on a daily basis and details of such shall be included in environmental reports submitted to Mine EO (weekly). The Mine EO shall report water usage statistics to the Mine Manager and ECO on a regular basis (at least monthly).	Rehab &Closure			ECO (Monthly) Independent Environmental Auditor (Annual)		permits or regulations. (Water use records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Environmental awareness training shall include the requirement for all staff, employees and construction workers to report any excessively dusty conditions to the contractor or responsible representative and corrective and preventative measures are to be implemented.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Ensure appropriate action is taken to mitigate dust.	Visual observation that dust suppression is done effectively. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	The Applicant and Contractor(s) must ensure that no transported materials escape from the construction and mine vehicles (no spillage on roads or dust clouds). If necessary, the load bin of the vehicle shall be covered with a tarpaulin to prevent dust.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Prevent dust pollution or dust nuisance.	Visual observation that excessive dust is not created during transportation of construction materials. Dust Monitoring (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	The Mine shall maintain open and transparent communication with the community and surrounding landowners regarding air quality and shall supply monitoring records to the public upon request.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Maintain good relations with potential sensitive receptors, nearby residents.	Verify that communication with community is ongoing and that monitoring data is provided upon request. (Meeting minutes) (Monitoring records) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

21.12 VISUAL

ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Planning	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads (GNR 544 Activity 22)	Impact on sense of place	-13	-13	-15.17
		Visibility	-13	-13	-15.17
		Visual exposure	-13	-13	-15.17
Operation	Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads (GNR 544 Activity 22 and 39) Removal of ore Establishment of RoM stockpiles Waste rock dumps for backfilling Soil management Concurrent rehabilitation	Impact on sense of place	-14	-14	-16.33
		Visibility	-14	-14	-16.33
		Visual exposure	-14	-14	-16.33
Decommissioning	Dismantling and demolition of infrastructure Blasting Safety control Backfilling of pits and voids Slope stabilisation Erosion control	Impact on sense of place	-13	-13	-15.17
		Visibility	-13	-13	-16.17
		Visual exposure	-13	-13	-16.17
Rehabilitation & Closure	Landscaping Re-vegetation Restoration of natural drainage patterns Rehabilitation of external roads	Impact on sense of place	-10	-9	-10.5
		Visibility	-10	-9	-10.5
		Visual exposure	-10	-9	-10.5
VISUAL MANAGEMENT STRATEGY					

The strategy for managing impacts on visual impacts is based on the following principles:

The measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area). To address these, the following principles have been considered:

- Mitigation measures should be designed to suit the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness;
- It should be recognized that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective;
- Mitigation measures would be feasible and effective in reducing the visual impact on some residential views from within the proposed mining boundary and surrounding residents

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review
Planning	Plan lighting to limit visual intrusion.	During Planning phase	Applicant (Once-off)	Applicant	Environmental Manager (annual internal review) ECO (External review as required)
Construction	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
51. Visual Impact							
A	Soil berms will be used as visual screens where required and practicable.	Construction Operation	As required	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit visual impact.	Observation of reduced visual impact. (Mine EO weekly checklist) (ECO Monthly checklist/report) (Annual Performance Assessment Reports)
B	Natural vegetation establishment (self-succession) will be encouraged where needed, as per the detailed rehabilitation plan.	Rehab &Closure	As required	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit visual impact.	Observation that exposed areas are rehabilitated with natural vegetation (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	The mine will investigate an appropriate seed mix for the rehabilitation purposes should self-succession not establish on rehabilitated sites as needed, as per the detailed rehabilitation plan.	Rehab &Closure	As required	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit visual impact.	Observation that exposed areas are rehabilitated with natural vegetation (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping, will be adopted as needed, as per the detailed rehabilitation plan.	Rehab &Closure	As required	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit visual impact.	Observation that exposed areas are rehabilitated with natural vegetation (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Final shaping will be implemented, such that, the final profile of the	Rehab &Closure	As required	Applicant Contractor	Contractors EO (Daily)	Limit visual impact.	Observation that final profile emulate natural contours

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	rehabilitated mining areas are formed to emulate natural contours of the area.				Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)		(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	Dust suppression methods must be applied when necessary to restrict the visual impact of dust pollution.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit visual impact.	Observation that dust suppression is undertaken where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Vegetation clearance must be restricted to the minimum area possible to reduce the impact from dust.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit visual impact of dust.	Observation that minimum possible area required is cleared at any given time. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	Rehabilitate / restore exposed areas as soon as possible after construction and mining activities are complete.	Construction Operation Decommissioning Rehab &Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit visual impact of dust.	Observation that exposed areas are rehabilitated as soon as possible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	Public movement areas (pathways and roads) should be lit with low level ‘bollard’ type lights and avoid post top lighting.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise potential for light pollution	Verification that light design minimises light impact. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Where appropriate and feasible, the mine shall avoid high pole top security	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily)	Minimise potential for light pollution	Verification that light design minimises light impact.

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area.				Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)		(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

21.13 NOISE

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Planning	Pre-construction survey	Noise impact on communities	-1.25	-1.25	-1.25
Construction	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads(GNR 544 Activity 22) Establishing stormwater management measures (GNR 544 Activity 11)	Noise impact on communities	-1.5	-1.5	-2.25
Operation	Blasting Establishment of infrastructure and services Establishment of PCD's (GNR 544 Activity 11 and 12; GNR 545 Activity 10 and 19; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR	Noise impact on communities	-2	-2	-3

	544 Activity 9) Establishment of mobile office and ablution block (Category B Activity 4) Drilling Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads (GNR 544 Activity 22 and 39) Removal of ore Concurrent rehabilitation				
Decommissioning	Dismantling and demolition of infrastructure	Noise impact on communities	-1.5	-1.5	-2.25
Rehabilitation & Closure	Backfilling of pits and voids Landscaping Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Noise impact on communities	-1.5	-1.5	-2.25

NOISE MANAGEMENT STRATEGY

The strategy for managing impacts from blasting and vibrations is incorporated into this EMP and is based on the following principles:

- Legal Compliance; and
- Compliance with International Noise Limits as set by the World Health Organization, World Bank, and International Finance Corporation for residential use.

The criteria for this compliance are as follows:

- Using the noise limits for residential areas proposed by International IFC Noise Guidelines, namely 55 dBA during the daytimes; and 45 dBA during the night-times.
- If the existing ambient sound levels already exceed these levels the noise impact from the operation under investigation must not raise the ambient sound levels with more than 3 dB. Because the ambient sound levels in this area (specifically focusing on the group of receptors identified as NSD08) are already high this effectively raise the total noise limit to 48 dBA at night and 58 dBA during daytimes.
- The operation may not increase the ambient sound levels with more than 7 dB (a disturbing noise and prohibited by the National Noise Control Regulations), neither should it result in a noise level that is higher than the rural rating level as defined by SANS 10103:2008.

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review
Planning	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Construction	Implement technical management measures as	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit)

	per EMP				Independent Environmental Auditor (Annual)
Operation	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
52. Noise							
A	All reasonable precautions shall be taken to minimise noise generated on site, especially when working in areas, or on activities, that may impact on neighbouring land owners and users. Every effort shall be made to limit exceedingly noisy activities. Technical solutions to reduce the noise impact shall include, but is not limited to; • Using the smallest/quietest equipment for the particular purpose; • Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures; • Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20dBA. Portable acoustic shields should be used in the case where noisy	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Reduce potential for noise nuisance.	Visual observation that appropriate efforts are made to reduce noise levels. Visual inspection of plant and vehicles. (Noise Monitoring) (Complaints Register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).All construction vehicles and equipment are to be kept in good repair; • Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum; • Noise from labourers on site must be controlled; • The contractor must attempt to restrict noisy activities as far as is possible to times and locations whereby the potential for noise nuisance is reduced; • When working near (within 800 meters) to a potential sensitive receptor(s), the Contractor shall limit the number of simultaneous activities to the minimum; • All machines should be equipped with appropriate noise reduction equipment; • All machines should be roadworthy (including meeting maximum noise specifications); • The vehicles exhaust and baffle systems must be maintained regularly to ensure that the noise from these vehicles is within the required noise specification; • All plant and equipment must be operated in accordance with the specifications provided by the manufacturer; • Safety measures that generate noise, including reverse gear alarms, should be adjusted to minimise noise where possible.						

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
B	Noise and vibration monitoring shall be carried out in accordance with the monitoring plan to ensure compliance the relevant environmental noise regulations and standards. Noise monitoring will be undertaken throughout the life of the mining activities within the mining area to ensure noise levels comply with Safety and Health Standards.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Safety Department (Daily) Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Compliance with noise regulations. Avoidance of complaints relating to noise and blasting.	Assessment of monitoring reports to determine legal compliance. (noise monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	A maintenance programme will be investigated and implemented for the ventilation machinery.	Construction Operation	As required	Applicant	ECO (Monthly) Independent Environmental Auditor (Annual)	Reduce noise impact from mining activities.	Verification that mitigation is implemented where necessary and feasible. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	Vehicles will be equipped with mufflers where practical to reduce the emission of noise.	Construction Operation	As required	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Reduce noise impact from mining activities.	Verification that mitigation is implemented where necessary and feasible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Community involvement needs to continue throughout the project. Good public relations are essential. At all stages surrounding receptors should be educated with respect to the potential increase of noise from the mine. The information presented to stakeholders should be factual and should not set unrealistic expectations.	Planning Construction Operation Decommissioning	Prior to construction and ongoing	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Maintain good relations with community and potential sensitive receptors.	Verification that communication with community is ongoing. (CLF meeting minutes) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
F	Local residents should be notified of any potentially noisy activities or work and these activities should be undertaken at reasonable times of the day. These works should not take place at night or on weekends.	Planning	Prior to construction and ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Communication with sensitive receptors to ensure noise impacts are known along with mitigating actions to prevent unnecessary complaints.	Verification that communication with sensitive receptors is ongoing. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
G	Provide portable acoustic screens to enclose the drill rigs and compressors where necessary and feasible, and as directed by the Mine EO and/or ECO.	Planning Construction Operation Decommissioning	As required	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Reduce noise impact from preconstruction activities.	Verification that mitigation is implemented where necessary and feasible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.	Construction Operation	As required	Applicant	Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Reduce duration of noise impacts and potential for complaints.	Verification that mitigation measures are implemented where necessary. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
I	During the planning phase, consideration must be given to the noise mitigation measures required during the construction phase and which should be included in the tender document specifications and the design.	Planning	Prior to construction	Applicant	ECO (Once-Off) Independent Environmental Auditor (Once-off)	Proper planning to ensure adequate resources are allocated to noise mitigation measures during subsequent phases	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent	Reduce potential for noise nuisance and complaints.	Verify that site camps have been appropriately located. (Mine EO weekly

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
					Environmental Auditor (Annual)		checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
K	Apart from the requirement that noisy activities should be limited to normal business working hours, if possible, such activities should be avoided during cold and calm weather conditions, particularly during winter mornings (when ambient noise is carried most easily).	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Prevent nuisance to nearby residents and impact on sense of place.	Visual observation that activities on site do not cause unnecessary disturbance. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
L	A channel of communication should be established and promoted between the mine and surrounding stakeholders. All noise complaints must be recorded and investigated. If required, the complaints should be investigated by an acoustical consultant.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Ensure all complaints are recorded and addressed.	Confirmation that complaints are recorded and investigated. (Complaints register) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
M	As a general rule, construction operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993). The Applicant and Contractor(s) shall obtain a copy of the relevant noise regulations and take all reasonable measures to abide by these regulations. Sound pressure levels should not exceed the specified threshold level for the relevant area in accordance with SANS10103, as experienced by the nearest noise sensitive receivers (i.e. local residents).	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Compliance with noise regulations.	Assessment of monitoring reports to determine legal compliance. (noise monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
N	In the event that noise levels exceed the specified thresholds in terms of the	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily)	Limit the potential for noise nuisance.	Confirmation that noise levels do not exceed

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	noise regulations, the Applicant shall appoint a suitably qualified acoustic engineer to identify sources of the elevated noise levels and to suggest suitable and reasonable mitigation measures.	Decommissioning			Mine EO (Weekly) Independent Environmental Auditor (Annual)		specified thresholds. (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
O	With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact. Information that should be provided to the potential sensitive receptor(s) includes: • Proposed working times, • How long the activity is anticipated to take place, • What is being done, or why the activity is taking place, • Contact details of a responsible person where any complaints can be lodged should there be an issue of concern. The Mine shall maintain open and transparent communication with the community and surrounding landowners regarding noise and shall supply monitoring records to the public upon request.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Maintain good relations with potential sensitive receptors, nearby residents.	Verify that communication with community is ongoing and that monitoring data is provided upon request. (Meeting minutes) (Monitoring records) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
P	Reverse warning systems should be able to be disabled when it is required to use these vehicles at night from the mining area close to receptors, alternatively the developer should investigate the use of white-noise generators instead of reverse alarms.	All phases	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Minimize potential annoyance	No noise complaints (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports

21.14 BLASTING AND VIBRATION

ACTION PLAN					
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY					
PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Planning	N/A	N/A	N/A	N/A	N/A
Construction	N/A	N/A	N/A	N/A	N/A
Operation	Blasting Establishment of infrastructure and services Establishment of PCD's (GNR 545 Activity 10 and 19; GNR 546 Activity 5; Category B Activity 1 and 10; Category C Activity 2) Establishment of dewatering pipelines (GNR 544 Activity 9) Establishment of mobile office and ablution block Drilling Blasting Excavations (GNR 545 Activity 20) Removal of overburden by dozing and load haul Establishment of internal haul roads (GNR 544 Activity 22 and 39) Removal of ore Concurrent rehabilitation	Ground vibration impact on houses	-2	-2	-2.33
		Ground vibration impact on boreholes	-2	-2	-2.33
		Ground vibration impact on roads	-2	-2	-2.33
		Air blast impact on houses	-2	-2	-2.33
		Air blast impact on boreholes	-1	-1	-1.17
		Air blast impact on roads	-1	-1	-1.17
		Fly rock impact on houses	-2	-2	-2,33
		Fly rock impact on boreholes	-1.25	-1.25	-1.46
		Fly rock impact on roads	-4	-4	-4.67
		Impact of fumes on houses	-1.25	-1.25	-1.46
		Impact of fumes on boreholes	-1	-1	-1.17
		Impact of fumes on roads	-1	-1	-1.17
Decommissioning	N/A	N/A	N/A	N/A	N/A
Rehabilitation & Closure	N/A	N/A	N/A	N/A	N/A

BLASTING AND VIBRATION MANAGEMENT STRATEGY

The action plan for managing impacts from blasting and vibrations is incorporated into this EMP and is based on the following principles:

- Mitigation measures for blasting should not be generic, but rather should be designed for individually for each of the POI's that are considered problematic specific to the site.
- The reduction of ground vibration is mitigated through;
  - Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast.
  - Calculate expected ground vibration levels for blast to be done and if necessary re-design to reduce change mass per delay, use of electronic initiation of blast, drilling smaller diameter blastholes that will reduce charge per blasthole and per delay.
- The reduction of air blast and fly rock is mitigated through:

- Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast.
- Use of proper stemming lengths of between 25 and 30 blasthole diameters,
- Use of crushed aggregate with size of 10% the blasthole diameter as stemming material.
- Record stemming lengths for each blast and correct if necessary prior to every blast blasted.
- Monitor each blast done.

IMPLEMENTATION PLAN

Phase	Management Action	Timeframe for Implementation	Review/Repeat frequency	Responsible Party For Implementation	Responsible Party For Monitoring and Review
Planning	Obtain necessary licences and permits for storage/handling/disposal of explosives	Prior to construction	Environmental Officer (weekly)	Specialist	Environmental Manager (annual internal review) ECO (External review as required)
Construction	Implement blasting and vibration management plan	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Monitor blasting and vibration management plan	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Monitor blasting and vibration management plan	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Monitor blasting and vibration management plan	Throughout decommissioning	Environmental Officer (weekly)	ECO (Monthly audit)	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental

					Auditor (Annual)
	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

Item No.	Technical or Management Option	Phase	Timeframes	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
	TECHNICAL OR MANAGEMENT OPTIONS						
	53. Blasting and Vibration						
A	The reduction of ground vibration is fundamental in different ways and shall include the following measures: • Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast • Calculate expected ground vibration levels for blast to be done and if necessary re-design to reduce change mass per delay, use of electronic initiation of blast, drilling smaller diameter blastholes that will reduce charge per blasthole and per delay.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Ensure safety is maintained during blasts and prevent damage to structures and minimise potential for public nuisance.	Verify that appropriate mitigation measures are implemented. (Approved blast designs) (Blasting reports) (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	The reduction of air blast is fundamental in different ways and shall include the following measures: • Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast. • Use of proper stemming lengths of between 25 and 30 blasthole diameters. • Use of crushed aggregate of 10% the blasthole diameter as stemming material • Record stemming lengths for each blast and correct if necessary prior to every blast blasted.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Ensure safety is maintained during blasts and prevent damage to structures and minimise potential for public nuisance.	Verify that appropriate mitigation measures are implemented. (Approved blast designs) (Blasting reports) (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	• Monitor each blast done.						
C	The mine should liaise with local residents on how best to minimise the impact of blasting. Information that should be provided to the potential sensitive receptor(s) includes: • Proposed blasting schedules, • How long the activity is anticipated to take place, • What is being done, or why the activity is taking place, • Contact details of a responsible person where any complaints can be lodged should there be an issue of concern. The Mine shall maintain open and transparent communication with the community and surrounding landowners regarding blasting and vibration and shall supply monitoring records to the public upon request.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) Independent Environmental Auditor (Annual)	Maintain good relations with potential sensitive receptors, nearby residents.	Verify that communication with community is ongoing and that monitoring data is provided upon request. (Meeting minutes) (Monitoring records) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	The Applicant should undertake a crack survey at the houses of directly affected neighbours prior to the onset of construction. Data obtained during this survey should be utilised to validate any complaints received relating to infrastructure damage as a result of construction or mining operations.	Planning Construction Operation	Prior to construction	Applicant	ECO (Once-off) Independent Environmental Auditor (Once-off)	Establish baseline condition of houses prior to construction and mining to be used for comparison in the event of claims.	Verify that crack survey has been undertaken. Results of crack survey. (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

21.15 TRAFFIC

ACTION PLAN			
ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY			
PHASE	**ACTIVITY**	**IMPACT**	**SIGNIFICANCE**

			Pre-mitigation	Post-mitigation	FINAL Significance
Planning	Pre-construction survey	Impact on adjacent road network	-5.5	-5	-8.33
		Impacts on links and intersections	-5.5	-5	-8.33
		Impacts on bridges and culverts	-5.5	-5	-8.33
		Impacts on communities	-5.5	-5	-8.33
Construction	General construction activities Earthworks Establishment of internal haul roads (GNR 544 Activity 22 and 39) Establishment of external haul roads (GNR 544 Activity 22 and 39)	Impact on adjacent road network	-9.75	-9	-15
		Impacts on links and intersections	-9.75	-9	-15
		Impacts on bridges and culverts	-9.75	-9	-15
		Impacts on communities	-9.75	-9	-15
Operation	Access control and security Removal of overburden by dozing and load haul Transport of coal product Transport of employees Establishment of internal haul roads (GNR 544 Activity 22 and 39) Upgrade of existing roads (GNR 544 Activity 47 and GNR546 Activity 19) Removal of ore (GNR 545 Activity 20)	Impact on adjacent road network	-10.5	-9.75	-16.25
		Impacts on links and intersections	-10.5	-9.75	-16.25
		Impacts on bridges and culverts	-10.5	-9.75	-16.25
		Impacts on communities	-10.5	-9.75	-16.25
Decommissioning	Dismantling and demolition of infrastructure Backfilling of pits and voids	Impact on adjacent road network	-5	-4.5	-7.5
		Impacts on links and intersections	-5	-4.5	-7.5
		Impacts on bridges and culverts	-5	-4.5	-7.5
		Impacts on communities	-5	-4.5	-7.5
Rehabilitation & Closure	Landscaping Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Impact on adjacent road network	-4	-3.5	-5.83
		Impacts on links and intersections	-4	-3.5	-5.83
		Impacts on bridges and culverts	-4	-3.5	-5.83
		Impacts on communities	-4	-3.5	-5.83

TRAFFIC MANAGEMENT STRATEGY

The traffic impact assessment has indicated that no significant impacts are expected as a result of increased traffic, should the mining take place. The action plan for managing impacts as a result of increased traffic are incorporated into a **traffic management plan** which adheres to the following principles:

- Make use of existing roads within the site where possible to minimise the impact;
- The traffic management shall identify appropriate routes for heavy vehicles to avoid communities and limit time of operation;
- Establish health and safety standards to safeguard public and workforce utilising roads;

- Monitoring of access roads to identify damage as a result of construction/mining activities.

IMPLEMENTATION PLAN					
Phase	**Management Action**	**Timeframe for Implementation**	**Review/Repeat frequency**	**Responsible Party For Implementation**	**Responsible Party For Monitoring and Review**
Construction	Implement technical management measures as per EMP	Throughout construction	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Operation	Implement technical management measures as per EMP	Throughout operation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Decommissioning	Implement technical management measures as per EMP	Throughout decommissioning	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)
Rehabilitation	Implement technical management measures as per EMP	Throughout rehabilitation	Environmental Officer (weekly)	Applicant	Mine EO (Weekly) ECO (Monthly audit) Independent Environmental Auditor (Annual)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
54. Traffic							
A	The mine shall ensure that the gravel road access road is adequately maintained, including monthly scraping.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Maintenance of gravel road in good condition	Verify condition of road surface. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
B	On-site vehicles must be limited to approved access routes and areas (including turning circles and parking)	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily)	Minimise footprint of environmental impact.	Visual observation of vehicle access.

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
	on the site so as to minimise excessive environmental disturbance to the soil and vegetation on site, and to minimise disruption of traffic.	Decommissioning Rehabilitation			Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)		(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
C	Site vehicles are only permitted within the demarcated construction camp or construction site as required to complete their specific task. The contractor must ensure that all staff his/her staff and employees remain within the demarcated construction site at all times.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Minimise footprint of environmental impact.	Visual observation of vehicle access. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
D	In the case of dual or multiple use of access roads by other users, arrangements for multiple responsibility must be made with the other users. If not, the maintenance of access roads will be the responsibility of the Applicant and/or Contractor(s). Road condition must be assessed regularly for signs of damage.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit safety risk due to damaged roads.	Visual observation of road condition. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
E	Damage caused to public roads as a result of the construction and/or mining activities shall be repaired in consultation with the relevant municipal authorities.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit safety risk due to damaged roads.	Visual observation of road condition. Verification that damaged roads are adequately repaired. (Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
F	Heavy vehicles should not travel at night, they should be clearly marked for visibility purposes, and travel during peak times should be avoided. These precautions should be written into the contracts of all service providers, and they should be fined if they do not adhere to the requirements.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors Safety Officer (weekly) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Limit the potential for road accidents.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
G	Vehicles should be in good working condition to prevent disruption of traffic in adjacent road networks and internal roads.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Visual observation of plant and vehicles for compliance with EMPR requirements.	(Mine EO weekly checklist) (ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
H	All construction and mining vehicles using public roads shall be in a roadworthy condition and their loads secured. They must adhere to the speed limits and all local, provincial and national regulations with regards to road safety and transport.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Visual inspection of vehicles for compliance with EMPR requirements.	(Vehicle inspection records) (Annual Performance Assessment Reports)
I	Proper signage must be present in the vicinity of the site to prevent accidents. Adequate and appropriate traffic warning signage and appropriate speed limits for construction vehicles should be implemented and adhered to.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) ECO (Monthly) Independent Environmental Auditor (Annual)	Adequate traffic signage to prevent accidents.	(ECO Monthly Checklist/Report) (Annual Performance Assessment Reports)
J	Speed humps may be constructed where appropriate to avoid speeding. Experienced drivers should be hired to drive construction vehicles in order to prevent disruption of traffic on adjacent road network and internal roads.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly)	Driver competency to be audited by HSE department.	Visual observation that vehicles are not speeding. (HSE inspection reports) (Annual Performance Assessment Reports)
55. Proposed mitigation measures for access roads and infrastructure							
A	The traffic impact assessment determined that no mitigation measures will be required with regards to capacity as the additional development traffic will have a minimal impact at the intersections. However, in terms of the geometry, mitigation measures should be considered at the following intersections to accommodate the heavy vehicles, in particular interlink vehicles for hauling coal, particularly from a manoeuvrability perspective: Mine access / Gravel Road 2 and Gravel Road 2 / N2. The mitigation measures suggested are as follows: • Minimum width of 4m for all lanes on approach to intersection; • Increasing the corner radii to 20m to ensure abnormal roads do not run over the pavement; • Right turn refuges at all intersections that are able to accommodate two heavy vehicles without restricting the flow of traffic; These mitigation measures are suggested in order to ensure that the heavy vehicles are able to successfully negotiate these intersections without running onto the pavement edges and causing damage and that they are safe for all users. With regards to the links themselves the traffic assessment showed that none of the links require upgrades in terms of capacity, but as with the intersections, mitigation measures may be required in order to ensure the roads stay in a condition fit for their purpose.						
B	It is assumed that the access to the mine will be via the existing Gravel Road 2. Currently the access road is not paved and it is recommended that the road be paved in the future. The reason for paving this road is to reduce the amount of gravel surfacing been dislodged. The road should be a minimum width of 4m per lane.						

TECHNICAL OR MANAGEMENT OPTIONS							
Item No.	**Technical or Management Option**	**Phase**	**Timeframes**	**Responsible Party for Implementation**	**Monitoring Party (Frequency)**	**Target**	**Performance Indicators (Monitoring Tool)**
C	Gravel Road 2 is currently in a good condition and at present requires no upgrades. It is recommended that the condition of the road is monitored during the lifespan of the mine and be maintained as and when required.						
D	Should road widening be required, this widening should be carried out to specification in line with the expected vehicle loading in the future and to the relevant local authority standards and requirements.						
E	As part of the workings a number of haul roads will be constructed within the mine to allow access to the coal stockpile and the site offices. The width of these roads will vary between 10m and 22m, depending on their purpose and final destination. These should be designed as gravel roads with the required layer works to ensure that they are fit for their purpose.						
F	Within the site there are a number of ponds and streams that have important, sensitive eco-systems associated with them. Ensure that roads are located outside of wetland areas by designing the mine layout in such a way that the routes avoid these sensitive areas.						
G	For the external road network it is recommended that a structural assessment of the culverts themselves is undertaken. This is required in order to determine the structural condition of these culverts. Once this has been carried out it will be possible to determine if these culverts have the structural integrity to cope with the expected loadings during the operational lifespan of the mine. If mitigation measures are required then it is recommended that they are designed to have as little impact as possible and should be designed in such a way that they can be removed at a later stage, if required.						

22 PLANNED ENVIRONMENTAL MONITORING

22.1 ENVIRONMENTAL ASPECTS THAT REQUIRE MONITORING

The monitoring of various environmental aspects and the impact on them as a result of the proposed project shall take place by means of both quantitative and qualitative techniques in order to determine whether or not the requirements of the Environmental Management Programme are being complied with. The importance and value of detailed environmental monitoring networks cannot be overstated.

Environmental monitoring serves as a tool to track compliance, assist with potential liability identification and mitigation throughout the life of the proposed project. This is achieved through the provision of actual evidence based monitoring and reporting thereof. In essence, monitoring is a continuous data-gathering, data interpreting and control procedure that ranges from visual inspection to in-depth investigative monitoring and reporting. The environmental monitoring considerations presented below are those related to the preferred development alternative namely, Alternative 3 – The Sensitivity Planning Approach.

These monitoring plans need to be drawn into standalone plans that can be updated and amended as per authority requirements and additional data requirements identified during the mining activities. These plans need to include the site specific roles and responsibilities for actions.

22.2 GEOCHEMISTRY MONITORING

Geochemical monitoring is recommended in conjunction with ground and surface water monitoring. Surface water quality monitoring is to be undertaken at the monitoring points identified by the hydrological specialists and the results of which are to be benchmarked against the SANS 241:2011 Class 2 standards as well as baseline water quality as described in Table 35 below:

Table 35: SANS 241:2011 Class 2 Standards

Constituents	Units	Class 1 (Recommended Operational Limit)	Class 2 (Max. Allowable Limited Duration)
TDS	mg/ℓ	< 1 000	> 1 000 - 2 400
pH	pH units	5.0 - 9.5	> 4.0 - 10.0
Conductivity	mS/m	< 150	> 150 - 370
Sodium	mg/ℓ Na	< 200	> 200 - 400
Sulphate	mg/ℓ SO_4	< 400	> 400 - 600
Iron	mg/ℓ Fe	< 0.20	> 0.20 - 2.0

Manganese	mg/ℓl Mn	< 0.10	> 0.10 - 1.0
Aluminium	mg/ℓ	< 1 000	> 1 000 - 2 400

Furthermore, the groundwater monitoring system must include the following geochemical considerations with regard to monitoring borehole placement and groupings:

- **Source monitoring:** monitoring boreholes are to be placed close to or in the source of contamination to evaluate the impact thereof on groundwater chemistry;
- **Plume monitoring:** monitoring boreholes are placed in the primary groundwater plume's migration path to evaluate the migration rates and chemical changes along the pathway;
- **Impact monitoring:** monitoring of possible impacts of contaminated groundwater on sensitive ecosystems or other receptors. These monitoring points are also installed as early warning systems for contamination break-through at areas of concern; and
- **Background monitoring:** background groundwater monitoring is essential in order to evaluate the impact of a specific action or pollution source on groundwater chemistry.

In the operational phase and closure phase, quarterly monitoring of groundwater quality and groundwater levels is recommended. Quality monitoring should take place before, after and during the wet season, i.e. during September and March. It is important to note that a groundwater-monitoring network should also be dynamic. This means that the network should be extended over time to accommodate the migration of potential contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources.

The identification of the monitoring parameters is crucial and depends on the chemistry of possible pollution sources. They comprise a set of chemical parameters. Once a pollution indicator has been identified it can be used as a substitute to full analysis and therefore save costs. The use of pollution indicators should be validated on a regular basis in the different sample position. The parameters should be revised after each sampling event; some metals may be added to the analyses during the operational phase, especially if the pH drops. Pollution indicators are provided in Table 35 above.

22.3 BIODIVERSITY MONITORING

Biodiversity monitoring must consider both floral and faunal environmental aspects as discussed below. It must take place on all surface mining activities and infrastructure as well as other areas disturbed by the proposed mining activities and includes the downstream wetland areas. A biodiversity monitoring report must be compiled yearly from monthly monitoring reports and included in the submission to any authorities in order to demonstrate compliance.

22.3.1 FLORA

Monitoring is recommended during all project phases and includes the monthly monitoring of the following aspects and take place around all surface mining activities and infrastructures, as well as all areas disturbed by the mining activities, including downstream wetland areas:

- **Erosion:**
  The area affected by the mining activities and adjacent wetland area must be investigated and signs of erosion noted. This includes all areas modified by the mining activities, the wetlands downstream of the affected areas and the wetland areas for 50m upstream of the affected areas. Activities that may affect the site include all mine infrastructure, all areas cleared of vegetation and all areas fenced in. If erosion is recorded, the location and size of the erosion feature must be noted. Any active erosion, caused by the construction activities, on site and in the wetland adjacent to the site must be stabilised as soon as possible to prevent damage to the environment. If an erosion feature starts, or increases in size after construction has started, it must be treated as though it was caused by the mining activities as the onus is on the landowner or lessee to rehabilitate the wetland. Furthermore it is both cheaper and more effective stabilising erosion at an early stage. Erosion monitoring includes monitoring of headcuts, sheet erosion and rill erosion. In all instance, erosion must remain the same in extent or decrease.
- **Erosion control measures:**
  Erosion control measures must be in place in all areas of the affected project site where erosion is likely to occur, especially in areas cleared of vegetation. Erosion control measures must be investigated monthly and after each rainfall event to ensure they are in good condition and functioning correctly. Any faulty erosion measures must be replaced or corrected immediately in order to prevent sedimentation in water courses, including wetlands.
- **Invasive species:**
  Invasive species on site and directly downstream of the site (500 m) must be monitored to ensure that infestations are prevented and controlled. Control methods appropriate to the specific invasive species must be used. It is strongly recommended that invasive species across the project site, except the forestry plantation, be controlled. As part of invasive species control the following components must be considered and evaluated:
  - Size of area covered;
  - Average size of mature growth;
  - Average size of seedlings;
  - Cover abundance of mature growth;
  - Cover abundance of seedlings;
  - What controls (mechanical, chemical etc.) were utilised; and

- Success of controls utilised.

Effective control of invasive species should result in the decrease in the size and number of infestations

- **Rehabilitation:**

A series of fixed plots or transects are required for rehabilitation biodiversity monitoring. At least six plots or transects are recommended of 10m x 10m. The plots must be randomly located in areas subject to rehabilitation and must not contain any access roads still in use. As part of the biodiversity monitoring during rehabilitation the following is further recommended:

- During year 1 of rehabilitation a basal cover of at least 15% is required with the proviso that this will be an annual pioneer species and they can be easily measured through the use of basal cover measurement;
- During year 3 of rehabilitation, vegetation cover is now used as the sampling point and a crown cover of at least 70% is required in terrestrial areas and 90 % cover in wetland areas. Included is a further requirement to monitor and ensure that basal cover is not reducing;
- Post year 3, percentage cover of pioneer vs. sub-climax species is required. Pioneer cover may be up to 70 % but less is preferred while pioneer species in wetlands should not be more than 30%;
- Rehabilitation monitoring must continue to take place to ensure that the required vegetation cover, as described above, is present for a minimum of two consecutive years

22.3.2 FAUNA

Proposed monitoring is derived from mitigation measures and the need to evaluate whether they have been successfully implemented or not. Proposed monitoring includes monitoring compliance of the following:

- All vacant areas affected by mining to be rehabilitated;
- Permits obtained for all protected species affected by mining activities;
- Faunal walk-through survey completed;
- Faunal search and rescue survey completed;
- Adequate offset habitat secured for conservation;
- Dust settling limited to region less than 100 m from operations;
- No damage to surrounding landscapes by mining equipment of personnel;
- No significant difference between mine impacts and surrounding land use impacts on animal mortality due to operational activities.

These are to be integrated into an overall Biodiversity Management Plan for the Mining Site as well as for the entire Mining Rights Area.

The management plan should include a conceptual management strategy, baseline data requirements, proposed monitoring locations, recommended data sampling and collection, recommended methods and materials, applicable parameters and standards, recommended timeframes and responsibilities for implementation of the plan, targets and performance indicators, recommended data interpretation, trending and analysis, reporting of findings, and recommendations for auditing and reviewing the findings and plan.

- Conceptual management strategy

  In principle, the strategy of the management plan should be to minimise mining impacts on fauna and faunal habitats.

  Objective 1: Minimize mining-related impacts on individuals and populations of fauna, especially species of conservation concern.

  Objective 2: Minimize mining-related impacts on faunal habitats, especially for species of conservation concern.

- Baseline data requirements

  Monitoring should be undertaken to evaluate the success of mitigation measures. The data requirements therefore depend on the mitigation measures as discussed below.

Table 36: Mitigation measure data requirements

No	Mitigation measures	Data requirements
A	Rehabilitation Programme should be established before operation	Location and extent of areas requiring rehabilitation. Location and extent of areas successfully rehabilitated.
B	Obtain relevant permits for the destruction of any protected species	Register of permits.
C	Undertake a pre-construction faunal walk-through survey of the footprint of the proposed infrastructure.	Confirmation of completion of walk-through survey. List of species of concern occurring within the footprint area of the proposed mine infrastructure.
D	Search of rescue of listed sedentary animals within the footprint of the proposed infrastructure	Confirmation of search and rescue.
E	Offset habitat must be sought and secured for conservation. The offset habitat must match as closely as possible the species composition and ecological characteristics of the habitat that will be lost.	Location and extent of affected habitat requiring offset arrangement. Location and extent of offset area. Data on ecological characteristics of affected habitat and offset habitat, including botanical and faunal species composition and abundance.
F	Suppression of coal dust from mining operations	Presence of coal particulate matter on surfaces at varying distances from coal mine in different directions from coal mine.
G	Limit access to non-mining areas by machinery and personnel	Location and extent of mining area in order to indicate no-go areas beyond that.
H	Implement monitoring programme to document rates of mortality due to collision impacts by flying animals and trampling mortality on roads due to vehicles and motorised machinery	Date, location and identity of animals killed by mine infrastructure or equipment. Likely cause of death also to be recorded.

Each of the following sections refers to the above mitigation measures.

22.3.2.1 Proposed Monitoring Locations

Table 37: Proposed monitoring locations

No	Monitoring location
A	At site of any area requiring rehabilitation.
B	Footprint area of the proposed mine infrastructure.
C	Footprint area of the proposed mine infrastructure.
D	Footprint area of the proposed mine infrastructure.
E	At site of habitat to be lost and at site of offset habitat.
F	Minimum of 3 sites at increasing distances from the mine in each of eight compass directions away from the mine (e.g. N, NW, W, SW, etc.).
G	Critical natural sites within the mining rights area.
H	Various sites along main access roads and underneath power lines or other significant vertical infrastructure. Also comparable sites away from mining area.

22.3.2.2 Recommended Data Sampling and Collection

Table 38: Recommended data sampling and collection

No	Data sampling and collection
A	Mapping using GIS system. Landscape function analysis on transects. Species composition in random sample sites.
B	List of affected species within the mining footprint.
C	List of affected species within the mining footprint.
D	List of affected species within the mining footprint.
E	Species composition in random sample sites.
F	Coal dust on horizontal surface, such as leaves of plants.
G	Damage to natural areas by mine equipment.
H	Identity of carcasses.

22.3.2.3 Recommended Methods for Collecting Data

Table 39: Recommended methods for collecting data

No	Data collection methods
A	GPS in field and/or mapping from aerial imagery. Published methods of LFA. Published standard methods of vegetation sampling.
B	Visual observation.
C	Visual observation.
D	Visual observation and capture using trapping methods.
E	Published standard methods of vegetation and fauna sampling.
F	Check with air quality specialist.
G	Visual observation, photographs, reports from land-owners.
H	Visual observation.

22.3.2.4 Parameters and Standards

Table 40: Parameters and standards

No	Data parameters and standards
A	1:10 000 scale, accurate to within 1 m. As per published methods of LFA. As per published standard methods of vegetation sampling.
B	Knowledge of species identification required.
C	Knowledge of species identification required.
D	Knowledge of species identification required.
E	As per published standard methods.
F	Check with air quality specialist.
G	None.
H	Knowledge of species identification required.

22.3.2.5 Recommended Timeframes and Responsibilities for Implementation

Table 41: Recommended timeframes and responsibilities for implementation

No	Recommended timeframes for implementation	Responsible person
A	Prior to rehabilitation, 6-monthly thereafter	ECO, Environmental officer
B	Prior to construction.	ECO, Specialist
C	Prior to construction.	ECO, Specialist
D	Prior to construction.	ECO, Specialist
E	Prior to construction.	ECO, Environmental officer
F	3-monthly (each season)	ECO, Environmental officer
G	Ad hoc on the basis of observed incidents.	ECO, Environmental officer
H	3-monthly (each season)	ECO, Specialist

22.3.2.6 Targets and Performance Indicators

Table 42: Targets and performance indicators

No	Target	Performance indicator
A	All vacant areas affected by mining to be rehabilitated	Species composition and landscape functionality of rehabilitated areas relative to well-managed secondary habitat of the same area.
B	Permits for all protected species affected by mining activities	Legal compliance
C	Walk-through survey completed.	Walk-through survey completed.
D	Search and rescue survey completed.	Affected animals successfully released.
E	Adequate offset habitat secured for conservation.	Target ratio of offset habitat secured.
F	Dust settling limited to region less than 100 m from operations	Levels of coal dust in surrounding areas.
G	No damage to surrounding landscapes by mining equipment of personnel.	Rate of damage to surrounding habitats.
H	No significant difference between mine impacts and surrounding land use impacts on animal mortality due to operational activities	Mortality rates

22.3.2.7 Data Interpretation, Trending and Analysis

Table 43: Data interpretation, trending and analysis

No	Data interpretation	Trending	Analysis
A	Mapping using GIS system to determine areas successfully rehabilitated. LFA score can be compared across time or across space. Species composition or diversity score	Should increase in area or proportion. Should show increase in functionality.	Area or proportion. Simple bar graphs.
B	Checklist to be compared to protected species lists.	None.	None.
C	Checklist only, no interpretation required.	None.	None.
D	None.	None.	None.
E	Species composition or diversity score	Direct comparison between sites.	Simple bar graphs. Shared species analysis.
F	Amount of dust settling on horizontal surfaces.	Should decrease rapidly with distance from mine.	Distance trends and seasonal trends to be interpreted with respect to effects on ecosystems and species.
G	Compliance with management measure.	Should never occur.	None.
H	Number of deaths per species, according to different infrastructure components or activities.	Should remain relatively constant. Can compare to number of trucks/vehicles.	Correlation with activities/location of infrastructure.

22.3.2.8 Reporting of Findings

All findings should be reported to mine management and competent authorities.

22.3.2.9 Recommendations for Auditing and Reviewing Findings

Auditing should be part of ISO14000 management system. Critical information should be reviewed by a fauna or biodiversity specialist on an annual basis.

22.4 SURFACE WATER MONITORING

The design and implementation of the surface water monitoring network will be undertaken in accordance with the Best Practice Guidelines G3: Water Monitoring Systems (DWAF, 2006). The aim of the surface water monitoring network is to assist with overall water management including but not limited to the following:

- Pollution prevention;
- Assess the performance of pollution prevention; and
- Develop a more holistic understanding of current, baseline water quality on site and the changes that result from mining activities.

It is strongly recommended that any water containment facility in site be subject to water quality and quantity monitoring and on a monthly basis. Quantity should be monitored to ensure the facilities are of a sufficient size for the water volumes they are expected to contain. The water quality results should meet applicable standards or ensure that water released into the environment, either intentionally or unintentionally, are of appropriate quality. The proposed surface water monitoring programme is described below in Table 44:

Table 44: Surface water monitoring programme outline

Aspect	Details	Monitoring Frequency
Surface Water	Sample point in the wetland upstream and downstream of mining activities	Monthly
	Clean water discharge points (if any)	
Drinking water	Treated or supplied water for domestic purposes	Monthly
Process water	Outlets of oil and grease traps, washbays, storm water containment, pollution control dams and sewage treatment facilities.	Monthly

The location of the proposed surface water monitoring network is described in Figure 82 below:

Figure 82: Surface water monitoring locations

Table 45: Surface water monitoring locations

	Longitude	Latitude
Site 1	30°18'17.811"E	26°51'55.976"E
Site 2	30°18'58.654"E	26°52'21.537"E
Site 3	30°18'53.72"E	26°51'53.988"E
Site 4	30°19'27.23"E	26°51'52.892"E

Surface water samples should be analysed for the parameters listed in Table 46 below on a monthly basis. On a bi-annual basis all samples should additionally be submitted for a full ICP-MS metal scan as described in Table 47, also below. This list of parameters should be amended annually to ensure all priority parameters are analysed monthly and lower-priority parameters are only analysed on a bi-annual basis.

Table 46: Parameters for monthly analyses

List of parameters for monthly analyses	
pH at 22°C	Chloride, Cl
Conductivity mS/m	Sulphate, SO4
Total Dissolved Solids	Nitrate, NO3
Calcium, Ca	Fluoride, F
Magnesium, Mg (mg/l)	Aluminium, Al
Sodium, Na	Manganese, Mn
Potassium, K	Iron, Fe
Total Alkalinity as CaCO3	Zinc, Zn
Bicarbonate, HCO3	

Table 47: List of parameters for bi-annual analyses

List of parameters for bi-annual analyses	
Antimony as Sb	Nickel as Ni
Arsenic as As	Selenium as Se
Barium as Ba	Silicon as Si
Beryllium as Be	Silver as Ag

Bismuth as Bi	Strontium as Sr
Cadmium as Cd	Tin as Sn
Cobalt as Co	Titanium as Ti
Lithium as Li	Vanadium as V
Mercury as Hg	Zirconium as Zr
Molybdenum as Mo	

The water quality results should be compared to the limits specified in the Water Use Licence (WUL). If a WUL is not available or limits for some parameters are not specified in the Water Use Licence, the Department of Water Affairs' (DWA) South African Water Quality Guidelines (SAWQG) Target Range, Volume 1, Domestic Use (1996) and the South African National Standards for Drinking Water (SANS 241:2011) should be utlised.

22.5 WETLANDS AND AQUATIC ECOLOGY MONITORING

The purpose of biomonitoring is aimed at assessing the ecological integrity of wetlands and rivers at the time of sampling in relation to the pre-mining condition. It is strongly recommended that the data contained in the Aquatic Ecology Specialist report serve as a baseline for future biomonitoring and that the sample sites listed below be included as a minimum:

Table 48: Biomonitoring Locations

Site	River Name	Latitude/Longitude	Subquarternary Reach	Description
N1	Ngwempisi River	26°51'12.51"° / 30°16'58.52°	W53A-1853	Ngwempisi River upstream of all impacts.
N2	Ngwempisi River	26°51'27.22"/ 30°17'16.14"E	W53A-1853	Ngwempisi River downstream of the haul road
N3	Ngwempisi River	26°50'24.27°/ 30°18'56.92°	W53A-1853	Ngwempisi River downstream of all impacts.
IBT	Unnamed tributary of Ngwempisi	26°51'37.59°/ 30°17'2.90°	Tributary of W53A-1853	Inter-basin Transfer entering the Ngwempisi River upstream of the site.
HT1	Unnamed tributary of Hlelo River	26°52'59.67°/ 30°17'50.71°	W52A-1934	Tributary of the Hlelo River – upstream of the site.
HT2	Unnamed tributary of Hlelo River	26°53'2.68°/ 30°18'38.59°	W52A-1934	Tributary of the Hlelo River – downstream of its confluence with T1 draining proposed and existing mining areas.

HT 3	Unnamed tributary of Hlelo River	26°53'11.60°/ 30°19'24.49°	W52A-1934	Tributary of the Hlelo River – downstream of the tributary draining the Open-cast.
HT 4	Unnamed tributary of Hlelo River	26°52'36.25"S /30°20'28.22"E	W52A-1934	Tributary of the Hlelo River – downstream of all Leiden activities.
T1	Unnamed tributary of Hlelo Tributary	26°52'33.44° /30°17'37.73°	Tributary of W52A-1934	Tributary draining proposed new underground mining areas.
W1	Unnamed tributary of HT	26°52'11.77/ 30°18'48.07	Tributary of W52A-1934	Valley Bottom Wetland draining proposed open-cast mining.

The following biotic components must be assessed on a bi-annual (twice/year) basis by a qualified aquatic ecologist:

- Monitoring and assessing freshwater macro-invertebrate communities, in terms of diversity and abundance. The assessment will be based on the SASS5 index according to the protocol of Dickens & Graham (2001), upstream and downstream of mining activities. The number of taxa with a moderate to high requirement for good water quality should be monitored relative to baseline conditions. The disappearance of one or more sensitive taxon from a site is likely to indicate deteriorating flow, habitat and/or water quality conditions;
- The Present Ecological State, based on SASS5, should be assessed using Dallas (2007) to provide a benchmark against which future changes can be measured. MIRAI (Thirion 2008) should additionally be considered to assess the response of the biota to changes in habitats, flow and water quality;
- Assessing the condition and availability of invertebrate habitats at each site according to the protocol of Kleynhans (1999) (Index of Habitat Integrity) and McMillan (1998) (Invertebrate Habitat Assessment System or IHAS). Fixed point photography should be used to facilitate the detection of habitat deterioration (e.g. erosion, sedimentation);
- On site biota-specific water quality parameters, i.e. pH, electrical conductivity, dissolved oxygen and temperature. Laboratory analysis of major anions and cations will provide further value to the biomonitoring programme, in terms of interpreting biotic responses to water quality stressors; and
- An assessment of fish integrity based on and appropriate index (FAII or FRAI). The prevalence of *Barbus pallidus* should be carefully monitored. Its disappearance from a site is likely to indicate deteriorating flow and/or water quality conditions

It is additionally recommended that Whole Effluent Toxicity (WET) testing be done on water sampled from pollution control facilities on site, as well as the wetland downstream of the open-cast mine and mine infrastructure. Where high levels of toxicity is detected, definitive testing should be conducted to determine dilution ratios required to render the water safe for aquatic biota. As watercourses are structurally and functionally linked to their adjacent wetland areas, it is further recommended that wetland integrity be monitored. Declining wetland integrity is likely to lead to a decline in the watercourses they drain into. A detailed water quality assessment should be conducted on all surface water and ground water resources, as per the recommendations given by a water quality specialist.

The resource quality objectives of downstream users should be complied with (as advised by DWA).It is also considered essential that flows leaving the Leiden study area be measured (e.g. by means of a v-notch weir) to ensure that flow requirements of downstream ecosystems are met (as advised by the DWA). As such the recommended performance indicators for biomonitoring are described in Table 49 below:

Table 49: Recommended performance indicators

Protocol/Frequency/Annum	Ngwempisi River	Hlelo Tributary	T1
On-site pH* (2)	6.5-9*	6.5-9*	6.5-9
On-site EC (2)	Max 15% change from baseline** (70mS/m) Maximum 100mS/m#	Max 15% change from baseline** (40 mS/m) Maximum 150mS/m#	Max 15% change from baseline** (70 mS/m) Maximum 150mS/m#
Habitat availability & integrity (2)	No significant changes in any one category (e.g. bank erosion, sedimentation, turbidity, alien vegetation, solid waste, water quality).		
SASS (2)	Minimum of 3 sensitive taxa	Minimum of 4 sensitive taxa	Minimum of 3 sensitive taxa
PES aquatic invertebrates (2)	No decline by more than 1 category	Minimum Category C; No decline by more than 1 category	Minimum Category C; No decline by more than 1 category
Fish (1)	*Barbus pallidus* present at least every 2nd survey	*Barbus pallidus* present downstream of study area at least every 2nd survey	*Barbus pallidus* present at least every 3rd survey
PES (FAII/FRAI) (1)	No decline below Category D	Minimum Category C; No decline by more than 1 category	Minimum Category C; No decline by more than 1 category
Toxicity Testing (2)	• Pollution control facilities - Maximum Category 2 (Slight toxicity hazard) • Wetland downstream of the Leiden Mining (sampled at W1 in Table 11-1): Category I (no toxicity hazard)		
Reporting (2)	Recommendations for management interventions made in biomonitoring reports should be followed up and follow up actions audited.		

After completion of each biomonitoring survey a biomonitoring report must be drafted and detail the following:

- Results of the survey;
- Spatial comparison between upstream and downstream sites;
- Comparison with historical data and baseline conditions; and
- Recommendations for management interventions.

22.6 GROUND WATER MONITORING

The groundwater monitoring network must be designed to comply with the risk based source-pathway-receptor principle. The groundwater monitoring network will be utilised to monitor the impact on water quality and quantity. The proposed monitoring boreholes associated with the groundwater monitoring network will be located so as to consider contaminant sources, receptors, potential contaminant plumes as well as background quality and quantities. As a result, the groundwater monitoring network will be designed to assess the following:

- Dewatering of the surrounding aquifers through the monitoring of groundwater levels in monitoring boreholes. This will include any other borehole identified within the modelled cone of depression;
- Groundwater inflow (ingress) into the mine workings through the monitoring of groundwater levels in monitoring boreholes including water volumes pumped from the mining work areas;
- Groundwater quality through the sampling of boreholes at the prescribed frequency as well as trending of groundwater quality results; and
- Groundwater recovery rates and potential for decant after physical mining operations cease through the drilling of additional monitoring boreholes into the underground workings which are to be drilled in the deepest sections of the mine. Stage curves will be drafted to further assess inflow into the defunct workings.

Groundwater monitoring must be undertaken in accordance with the SANS and DWA standards and according to the schedule as described in Table 50 below:

Table 50: Groundwater monitoring schedule

Monitoring Aspect	Sampling Interval	Analysis	Water Quality Standards
Construction, Operation, Decommissioning and Rehabilitation Phases			
All monitoring boreholes	Quarterly measurements of groundwater levels	N/A	N/A
All monitoring boreholes	Quarterly sampling for water quality analysis	Full analysis in April and October	South African Water Quality Guidelines: Domestic Use and Aquatic Ecosystem/WUL standards
Rainfall	Daily	N/A	N/A

The location of groundwater monitoring boreholes are illustrated in Figure 83 below and their positions in Table 51:

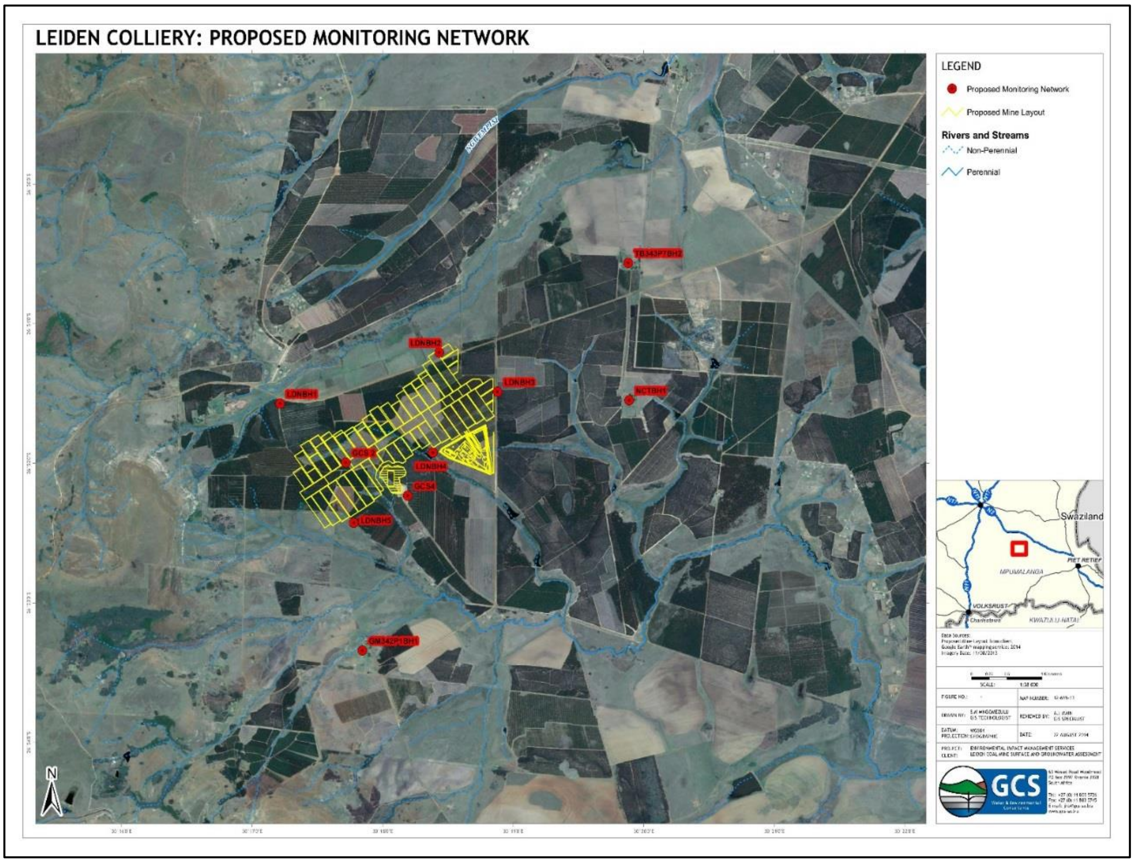

Figure 83: Proposed ground water monitoring network

Table 51: Groundwater monitoring borehole locations

Borehole ID	X Coordinates	Y Coordinates	Description
LDNBH1	-70865.48	-2972268	Monitoring borehole
LDNBH2	-68849.34	-2971579	Monitoring borehole
LDNBH3	-68105.9	-2972094	Monitoring borehole
LDNBH5	-69920.55	-2973839	Monitoring borehole
LDNBH4	-68922.36	-2972906	Monitoring borehole
GCS2	-70026.34	-2973042	Kangra monitoring borehole
GCS4	-69237.86	-2973477	Kangra monitoring borehole
NCTBH1	-66435.56	-2972198	Hydrocensus borehole
GM342P1BH1	-69801.87	-2975529	Hydrocensus borehole

TB343P7BH2	-66456.76	-2970382	Hydrocensus borehole

The parameters to be monitored and assessed are provided below and laboratory analysis must comply with SABS standards. Revision of the sampling parameters is required and additional metals must be added to the analyses should pH decrease during the operational phase.

- Full Analysis:
  - Physical parameters;
  - Groundwater levels; and
  - Chemical parameters inclusive of the following:
    - Field measurements: pH, EC;
    - Laboratory analyses : Anions and cations (Ca, Mg, Na, NO_3, Cl, SO_4, F, Fe, Mn, Al, & Alkalinity, pH, EC and TDS;
  - Petroleum hydrocarbons contaminants where applicable such as near workshops of petroleum handling facilities; and
  - Sewage related contaminants namely *E.Coli* faecal coliforms in boreholes in proximity to septic tanks or sewage plants.

The groundwater monitoring database must be updated on a monthly basis as information becomes available. The database should be used to analyse the information and evaluate trends noted. An annual compliance report should be compiled and submitted to the authorities for evaluation and comment. This report should be submitted annually for the construction, operational and decommissioning phases as well as for two years after mining ceases. The mine must develop a monitoring response protocol. This protocol will describe procedures in the event that groundwater monitoring information indicates that action is required.

22.7 AIR QUALITY MONITORING

In terms of air quality the main pollutant of concern is particulates. As such, the design and implementation of the air quality monitoring programme must incorporate the following considerations:

- Monitoring of select parameters namely dust fallout (TSP), PM_{10} and $PM_{2.5}$ concentrations at both source and receptor indicator sites;
- Use of source and receptor based key performance indicators in monitoring strategies, namely compliance with NAAQS and NDCR;
- Detailed identification and update of all emissions sources;
- Implementation of source based controls;
- Implementation of the technical management options stipulated in the EMPR;

- Internal and external auditing; and
- Review and amendment of the monitoring programme as required.

Based on the above considerations it is recommended that a dust fall network both on and off site be implemented at select locations with the thresholds as stipulated in the NAAQA and NDCR standards utilised as receptor based objectives. In addition, further PM_{10} source sampling is suggested for the underground vent to ensure compliance with Health and Safety Regulations, which supersede the standards of the NAAQA and NDCR in this instance. The NAAQQ and NDCR standards are indicated in Table 52 and Table 53 below.

Table 52: NAAQS SO_2, NO_x, PM_{10} and $PM_{2.5}$

Substance	Molecular Formula	Averaging Period	**Concentration (µg/m³)**	**Permitted Frequency of Exceedance**	**Compliance Date**
Sulphur Dioxide	SO_2	10 minutes	500	526	Immediate
		1 hour	350	88	Immediate
		24 hours	125	4	Immediate
		1 year	50	0	Immediate
Nitrogen Dioxide	NO_2	1 hour	200	88	Immediate
		1 year	40	0	Immediate
Particulate Matter	$PM_{2.5}$	24 hours	65	4	Immediate – 31 Dec 2015
		I Year	40	4	1 Jan 2016 – 31 Dec 2029
	PM_{10}	24 hours	25	4	1 Jan 2030
		I Year	25	0	Immediate – 31 Dec 2015

Table 53: NDCR Standards

Restriction Areas	Dustfall Rate (D) (mg/m²/day, 30 days average)(1)	Permitted frequency of exceeding dustfall rate
Residential Area	D < 600	Two within a year, not sequential months
Non-Residential area	600 < D < 1200	Two within a year, not sequential months

Dust fall monitoring is to be undertaken from the start of the construction phase and all the way through to closure phase and must be accompanied by quarterly reporting thereof. As a result of the above, a dust monitoring network comprised of (at a minimum) 5 dust buckets and a single PM_{10} monitor is recommended as portrayed in Figure 84.

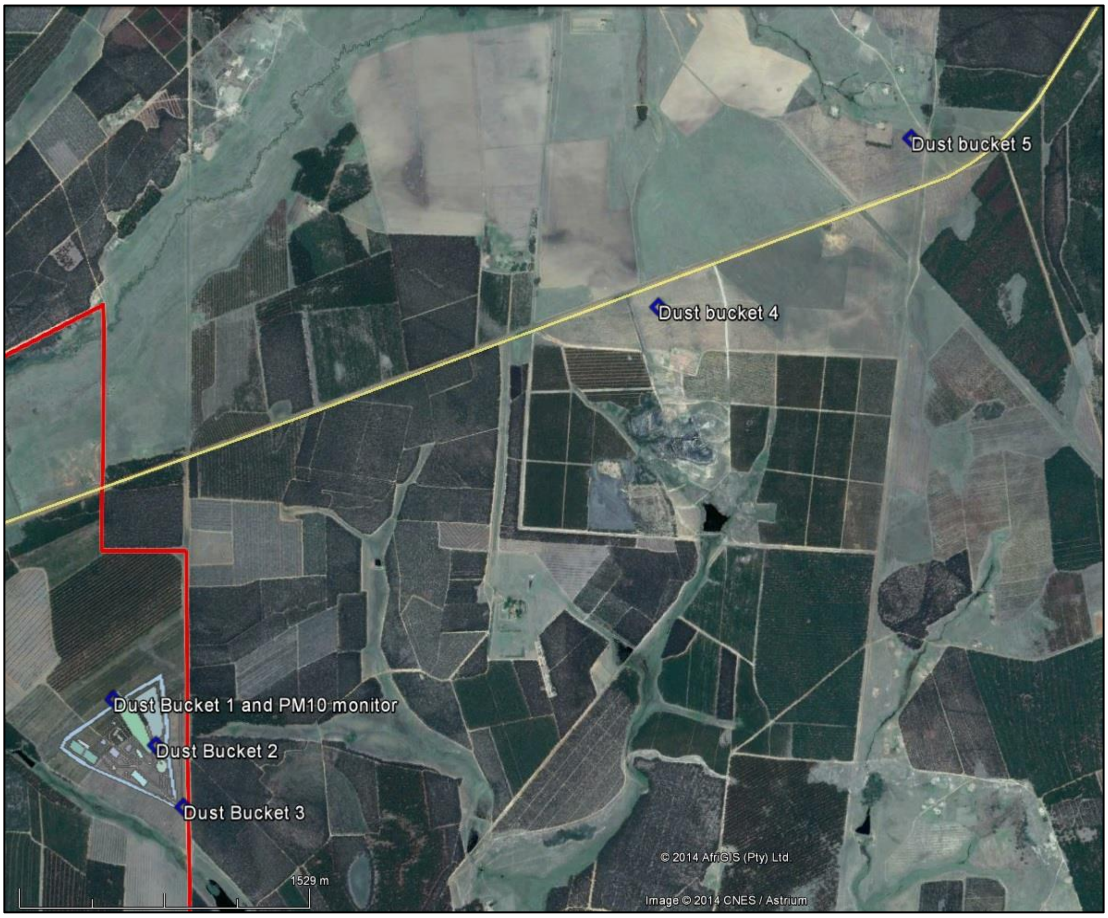

Figure 84: Dust fall monitoring locations

22.8 NOISE MONITORING

Environmental noise is divided into two distinct categories namely passive monitoring and active monitoring. Due to the low significance of a potential noise impact to develop, no active noise monitoring is recommended. However, should a complaint be registered the proposed Leiden Coal Mine must investigate the complaint and consider the following during the monitoring and follow up investigation:

- Noise measurement must be taken at the location of the person that registered the complaint. The measurement location must consider the direct surrounding to ensure that other sound sources cannot influence noise readings. A second measurement instrument must also be deployed simultaneously at the mine during the potential noise complaint measurement;
- Ambient sound measurements must be collected as defined in the SANS 10103:2008 standards. Due to variability that naturally occurs in sounds levels it is recommended that a semi-continuous measurement over a period of 16 hours which covers the full night time period of 22:00 – 06:00 be conducted;

- Measurements must be collected in 10 minute bins defining the 10 minute descriptors such as $L_{Aeq,I}$ (National Noise Control Regulation requirement), $L_{A90,f}$ (background noise level as used internationally) and $L_{Aeq,f}$ (Noise level used to compare with IFC noise limit). Spectral frequencies should also be utilised to define the potential origin of the noise;
- Measurements must be conducted during a period or in conditions similar to then the receptors experienced the noise event responsible for the complaint; and
- Noise measurements must also be conducted in accordance with the National Noise Control Regulations ((GN R154 of 1992) and SANS 10103:2008 standards.

On completion of the noise monitoring and investigation, a monitoring report must be drafted. The report must be provided to the complainant or noise sensitive receptor. Included in the report must be additional mitigation measures to be employed (if required) and indicate dates for further follow ups to ensure that noise complaint is adequately addressed.

22.9 BLASTING AND VIBRATION MONITORING

The design and implementation of a blasting and vibration monitoring programme must incorporate the following considerations:

- The Applicant must undertake a pre-blast baseline survey including photographic inspections of privately owned structures within 1500 m of the mine;
- Monitoring of each individual surface blast must be undertaken and the limits as stipulated by the blasting specialist) adhered to; and
- Further points for off-site vibration and blasting monitoring must also be identified in consultation with surrounding landowners and legal occupiers.

In addition, the following reconditions should be incorporated into the blasting and vibration monitoring programme:

- Blasting should not be undertaken in the early morning when it is still cool and the possibility of inversion is present or too late in the afternoon in winter;
- No blasting must be undertaken in the evenings;
- Refrain from blasting when wind conditions are unfavourable and in the direction of receptors;
- Development of a standard blasting time and placement of blast notices to inform I&AP's of blasting operations;
- Develop a list of all boreholes within the project area including location, conditions, and water levels;
- Maintain ground vibration levels below 50 mm/s;

- Document and audit each operation; and
- Provision of blast data and recordings to I&AP's who request it.

The following ground vibration and air blast levels are recommended for blasting operations in this area. Table 54 below gives limits for ground vibration and air blast.

Table 54: Recommended ground vibration and air blast limits

Structure Description	Ground Vibration Limit (mm/s)	Air Blast Limit (dBL)
National Roads/Tar Roads:	150	N/A
Electrical Lines:	75	N/A
Railway:	150	N/A
Transformers	25	N/A
Water Wells	50	N/A
Telecoms Tower	50	134
General Houses of proper construction	USBM Criteria or 25 mm/s	Shall not exceed 134dB at point of concern but 120 dB preferred
Houses of lesser proper construction	12.5	134
Rural building – Mud houses	6	134

Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. Additionally assistance may be sought when blasting is done close to the highways. This will bring about unbiased evaluation of levels and influence from an independent group. Monitoring could be done using permanent installed stations. Audit functions may also be conducted to assist the mine in maintaining a high level of performance with regards to blast results and the effects related to blasting operations.

22.10 REHABILITATION MONITORING

Once the final landform design has been established and stabilized (with re-vegetation or otherwise) the mine will provide for a period of monitoring to verify the success or otherwise of the rehabilitation program. The length of the monitoring period will be determined in consultation with the appropriate regulators and would take the form of periodic inspections by contracted specialists, but is generally assumed to last for at least 3 years for issues other than ground water and possibly more than a decade for ground water. This applies even to the areas directly returned to forestry.

The parameters that may be monitored after rehabilitation should subject to agreement with the regulator, include the following:

- the continued safety of the site,
- alignment of actual final topography to agreed planned landform.
- Depth of topsoil stripped and replaced.
- the establishment and growth of plants including the return of species not planted as part of re-vegetation, on the areas not returned to forestry
- the percentage of ground cover and species composition
- the return of native fauna (where eco-system restoration is intended)
- soil fertility, pH and salinity

- evidence of land erosion or land degradation
- the presence of vertebrate and invertebrate aquatic species identified in the EIA/EMP as indicator species,
- surface water drainage systems and surface water quality
- groundwater quality at agreed locations (including downstream)
- condition of downstream ecosystems.

23 THE EMPR PERFORMANCE ASSESSMENT

According to Regulation 55 of the MPDRA regulations compliance with the EMPR must be monitored on a continuous basis. This requirement shall be accomplished through the continuous monitoring of compliance undertaken by the Mine EO and ECO. The performance assessment will focus on the following Key Aspects:

- Compliance with the Approved EMPR;
- Compliance with the approved SLP; and
- Appropriateness and validity (technical content) of the EMPR.

An EMPR performance assessment report shall be submitted to the Department of Mineral Resources (DMR) after each year of mining and before applying for closure. The holder of the mining right may appoint an independent qualified person for the monitoring and to compile a report, but the responsibilities remain the holder's. The performance assessment will include:

- The period when the performance assessment was conducted;
- The scope of the assessment;
- The procedures used for conducting the assessment;
- Interpreted information gained from monitoring the EMPR (e.g. ECO reports);
- Evaluation criteria used during the assessment; and
- Results of the assessment are to be discussed and mention must be made of any gaps in the EMPR and how it can be rectified.

24 CLOSURE GOALS AND OBJECTIVES

The mine will be required to apply for a Closure Certificate according to Section 43 of the MPRDA. Section 43 (1) of the MPRDA stated that "the holder of a …mining right …remains responsible for any environmental liability, pollution or ecological degradation, and the management thereof, until the Minister has issued a closure certificate to the holder concerned".

It is therefore assumed that all environmental impacts will be successfully addressed and managed at this phase. When the decision is taken to decommission the mine, the activities below will be implemented:

- Recovery of all saleable infrastructure;
- Demolition of all buildings and structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation should self succession not take place;
- Ensure that all remaining stockpiles and slopes are sufficiently shaped to blend in with the surrounding environment and to ensure sustainable rehabilitation in the form of self succession;
- Amelioration and vegetation of all disturbed areas where necessary;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, ground water, surface water and air quality) in order to demonstrate stability of rehabilitated areas;
- Weed management by local people for three (3) years after closure, limited to areas disturbed by mining or included in the mining area; and
- Monitoring will be undertaken as per DMR"s requirements after closure or up until such time all areas create a sustainable cover and ecosystem.

Although it is assumed that all impacts will be managed and rehabilitated by the above objectives, some residual impacts will however still be present.

24.1 CLOSURE GOALS AND OBJECTIVES

Mining at Leiden will be a temporary land-use that affects only a small area when considered in a regional context. Closure objectives are physical, biological and chemical stability of the post-mining landform as well as regulatory approval and stakeholder support for the actions associated with this objective and outcome. These objectives counter the principal post-mining risks of

- post-closure site safety for casual access,

- restoration of native plant cover and ecology, where land is not returned to forestry
- protection of water resources, including wetlands
- and a post-mining environment in line with stakeholder needs.

The overall rehabilitation/ closure objectives for the Leiden are:

- Visual impacts of rehabilitated areas should be minimized by recreating natural landforms and ensuring that reshaped areas are visually suited to surrounding landforms.
- Soil integrity is the most important aspect of rehabilitation as it forms the base from which rehabilitation proceeds. In the rehabilitation of disturbed areas soils must be correctly prepared and suitably conditioned for re-vegetation sustainable vegetation to be achieved.
- Alien floral invasion poses a threat both during and post-rehabilitation activities, although this excludes species used in forestry on site, primarily pine (pinus radiata).
- The long term water pollution control approach will require the restoration of the area's natural pre-mining drainage patterns and volumes (both surface and underground) in order to be sustainable.
- The restoration and extension of wetlands to clean up chemical pollution from the site should be considered as a viable option to improve the downstream water quality in the catchment.

24.1.1 MINE CLOSURE PLANS AND SYSTEMS

In order for the mine closure plan to remain a living, relevant document through the operational phase of the Leiden project, a number of systems and processes need to be considered and put in place during the early stages of the project:

- The incorporation of rehabilitation and decommissioning options into the final design of operations as far as possible during the commissioning process.
- The monitoring and recording of material uncontrolled events on site that could impact on the scope of the closure process.
- The development of clearly defined rehabilitation plans, to monitor and review rehabilitation performance and ensure the progressive refinement of such plans, once the project commences.
- The calculation and budgeting for rehabilitation and decommissioning costs and their annual review for adequacy during the life of operation.
- The periodic review of rehabilitation and decommissioning strategies over the life of operations to incorporate changing legislative requirements, public expectations and environmental and cultural heritage information.
- The appointment of a person responsible for mine closure planning at a level that allows him/her to influence how the mine develops and operates and that allows

him/her to address issues and programs related to long-term responsibility for land management in the final closure plan.

24.2 POST-CLOSURE MONITORING AND MANAGEMENT

The post-closure monitoring and management period is anticipated to be 10 years at the Leiden Coal Mine. Monitoring activities during this period will include:

- The continued safety of the site,
- Alignment of actual final topography to agreed planned landform.
- Depth of topsoil stripped and replaced.
- The establishment and growth of plants including the return of species not planted as part of re-vegetation, on the areas not returned to forestry
- The percentage of ground cover and species composition
- The return of native fauna (where eco-system restoration is intended)
- Soil fertility, pH and salinity
- Evidence of land erosion or land degradation
- The presence of vertebrate and invertebrate aquatic species identified in the EIA/EMP as indicator species,
- Surface water drainage systems and surface water quality
- Groundwater quality at agreed locations (including downstream)
- Condition of downstream ecosystems.

The aspects listed above that should be monitored post-closure are a guide. Provision must be made to monitor any unforeseen impact that may arise as a result of the proposed mining activities and incorporated into post closure monitoring and management.

24.3 LAND USE FRAMEWORK AND REHABILITATION

24.3.1 DESCRIPTION OF THE SITE AT CLOSURE

Based upon the Alternative 3 project description, Leiden Coal Mine plans to operate as an underground mine only, operating a small mobile crusher for the Run of Mine prior to its transport directly to another site for processing (washing). At this stage a 10 year Life of mine is envisaged.

Access to the coal seams will be via a boxcut located near the centre of the Project area and will positioned in order to gain access to the coal seams with as little development as possible. The underground design incorporates the plan to mine the viable section of the deposit A bord width of 6.5m is planned leading to ensure an ~62% area extraction rate, while also maintaining the safety factor for pillars. No pillar extraction has been assumed in this mine closure plan.

As of mid-2014, the mine plan envisions a steady production of approximately 35 000 tons per month over 96 months, initially processing coal off-site to produce an Eskom product.

At present no open cast mining is envisaged beyond the decline shaft/box cut area on site. Beneficiation will be restricted to crushing and screening (no washing) prior to being transported off site. With no washing plant, there will be no need for slurry dams or co-disposal facilities, albeit that a dirty water/storm water control system and pollution control dam will still be needed to manage the dirty water runoff from the mining and crusher/screening footprint. However, until the extent of the additional beneficiation infrastructure required is understood, this mine closure plan must be based upon mining infrastructure limited to the boxcut portal, the crushing and screening plant as well as supporting infrastructure such as

- Pollution control dam;
- Return water dam;
- Storm water management including clean and dirty water seperation systems
- Access and haul roads;
- Pipelines
- Conveyor Belts
- Mobile Crusher
- RoM Stockpiles
- Weighbridge
- Salvage yard/sorting area;
- Waste tyre storage area;
- Diesel storage
- Chemicals storage
- Mobile Offices
- Mobile ablution blocks
- Pre-fabricated water purification plant
- Temporary waste storage areas
- Wash bay, effluent separation and water recycling system facilities;
- Dewatering infrastructure
- Explosives storage;
- Water storage;
- One decline shaft
- One ventilation shaft
- Modular Sewerage treatment plant; and
- Change rooms, store rooms and workshops, and other ancillary infrastructure.

Information regarding the mine works plan and the supporting on-site infrastructure was provided by the client at conceptual level only. As a result a number of assumptions were made concerning the infrastructure that may have to be considered during the decommissioning and closure of Leiden. These assumptions are based upon experience of other Mpumalanga province coal mines and the relative proportions of resources with the respective closure plans that are set aside for the decommissioning, demolition, rehabilitation and closure of different aspects of open cast coal mines. Following the completion of an approved, detailed mine works programme by Mashala Hendrina Coal (Pty.) Ltd. all of these assumptions will need to be revisited and verified against plans on the ground.

Pertinent to the estimation of the closure cost liability is the total surface footprint around the access portal of approximately 40 hectares including perimeter soil berms. Within this the following features with their approximate footprint are set out:

- Access and haulage roads partly off-site – ca. 1km or 10 000 square meters (1 hectare)
- Decline and ventilation shaft based upon a box cut of ca. 3 hectares (360 000 cubic meters)
- Temporary general waste collection and storage site (0.5 hectares)
- Land utilised for temporary overburden and topsoil storage (4 hectares)
- Carbonatious Stockpile/ Coal Stockpile area (4 hectares)
- Return water and storage dams (2 hectares)
- Stormwater control infrastructure (4 hectares)
- Wash bay, effluent separation, fuel storage and water recycling system facilities (2 hectares)
- Explosives storage; (2 hectares)
- Sewerage treatment plant; (1 hectare)
- Plant offices, change rooms, store rooms and workshops, and other ancillary infrastructure (5 hectares)
- Compacted land beyond other infrastructure, incl. area surrounding access portal (10 hectares)
- Otherwise disturbed land (provision for on- and offsite impacts) – 8 hectares

24.3.2 POST-MINING LAND USE FRAMEWORK

The identification and recording of pre-mining land use forms an essential component of the long term closure planning process. By identifying the pre-mining soil and land use capabilities, the objectives of post-closure land use can be set in order to re-instate, as far as ecological and commercial land use capabilities.

The post-mining land use vision for Leiden is the construction of a safe, stable and non-polluting land form so that following the cessation of mining, the area can be re-integrated into the current agricultural, wilderness and economic activities that reflect both the situation prior to the commencement of mining as well as the evolving interest of local land- and stakeholders. In addition, the post-mining land use vision must account for any potential structures or measures necessary to protect the interests of the downstream water users in the Usutu catchment.

24.3.3 FINAL LAND USE PLAN

The final, detailed form in which this will take place will be substantially influenced by:

- Stakeholder input around the time of closure,
- Topsoil availability throughout the project life cycle,
- The extent to which potentially polluted groundwater and near-surface water flows will require active management or containment infrastructure during the operational and post-closure phase.

As indicated in the EIA/EMP specialist studies, coal mining at Leiden will entail some impacts on some wetland areas, primarily through undermining. The wetlands on this site are predominantly hillslope seepage wetlands which depend on their catchments. Therefore the focus of environmental management during the operational phase must be on preventing impacts on the wetland habitat.

It will also be critical that the detailed handling instructions for topsoil stripping and stockpiling contained in the Chamber of Mines Guidelines for the Rehabilitation of Mined Land (2007) are adhered to at all times, in order to ensure that the maximum amount of suitable soil material is available for subsequent replacement into the void in a manner that allows for the restoration of approximate stratigraphy and surface contours as they existed prior to mining.

Current, pre-mining land use of the site consist primarily of forestry, along with wilderness area and some informal cattle grazing. As the principal surface impact of the mining operation will be limited to a small, compact area the focus here will be on rehabilitating this impacted zone in a manner that allows the restoration of the land use to forestry and where this is not possible to wilderness. For this purpose a single, free-draining contour will be established over the former mining zone which should allow the re-establishment of forestry while preventing the ingress of surface, or near surface water flows towards the worked-out underground workings. All pre-existing roads would be left in situ for forestry useage.

25 REHABILITATION AIMS AND OBJECTIVES

25.1 ASSUMPTIONS REGARDING THE ENVIRONMENTAL MANAGEMENT ACTIVITIES DURING THE OPERATIONAL PHASE MATERIAL TO THE DETERMINATION OF THE CLOSURE QUANTUM

The closure plan assumes that as part of the on-going pollution prevention activities described elsewhere in this EIA/EMP, Leiden colliery will, throughout the operational stage of the project, acquire and maintain adequate environmental management capacity among its staff which will be sufficiently resourced to ensure that the preventative and remedial measures listed in this EIA/EMP are implemented as described. In particular the following measures / activities will be implemented:

- No infrastructure will be constructed within the surface water exclusion zones (1:100 floodline zones)
- Restrict all activities to within the small mine zone around the decline shaft (ca 40 hectare area) and the public haul road.
- Buffer zones around the wetland areas would be strictly observed.
- As part of the site's clean dirty water separation approach, clean storm water will be diverted around the dirty water catchment in a controlled manner to tie in with existing surface drainage features and flow into the tributaries of the Usutu system,
- The water inside the polluted area would be collected through a series of polluted water drains.
- No permanent staff residence will be constructed on site or within the mining lease.
- No permanent waste disposal facility will be constructed on site.
- Domestic waste will be collected on site in clearly marked skip bins and transported off site by a contractor when full. Where possible, the domestic waste will be disposed of separately in clearly marked containers and recycled by contractors who will remove them off-site for commercial gain. A waste disposal certificate will be required from the contractors to ensure safe disposal.
- Hydrocarbon containing waste (used oil, dirty diesel and grease) will be stored in clearly marked skip bins (solids) and containers (liquids). These will be placed in an isolated area on a sealed surface. When full, the containers will be collected by a contractor for safe disposal or recycling companies will be appointed to collect waste. A waste disposal certificate will be required from the contractor to ensure safe disposal.
- Industrial waste (metals, rubber, tyres, conveyor sheets etc.) will be stored separately in clearly marked containers within a salvage yard and bartered off to recycling companies once or twice a year, depending on the volumes. A waste disposal certificate will be required from the contractor to ensure safe disposal.

- A package sewage treatment plant will be provided to handle sewage water generated from the change house, offices, workshop and store buildings. The sewage treatment plant will be sized to cater for a percentage of the total potable water demands for the operation. The treated sewage water will be piped from the sewage treatment plant to (and stored in) an industrial water reservoir in order to reduce make up water requirements.
- A wash bay complete with an effluent separation system and Oil/Water separator system will be implemented as part of the mine's water management activities.
- Any substation and power lines supporting the project will remain the responsibility of Eskom.
- The operation will actively refine and review its mine water balance and local ground water model during the operatiuonal phase of the mine in order to gain greater clarity on the post-closure measures necessary to contain water pollution.

25.2 MINE CLOSURE PROCESS

The Mine Closure Process which will be funded by the Financial Quantum for Closure which the project must set aside, consists of the following phases:

- Topsoil salvage during the construction phase,
- Implementation and operation of the EMP (incl. topsoil stockpile management) during operational phase,
- Making safe and the dismantling of infrastructure following decommissioning,
- Landform design, erosion control and re-vegetation,
- Monitoring, maintenance and relinquishment.

25.2.1 PHASE 1: TOPSOIL SALVAGE AND STOCKPILING DURING CONSTRUCTION PHASE AND IMPLEMENTATION AND OPERATION OF EMP DURING OPERATIONAL PHASE

Following project approval the project should put clear instructions and systems in place to ensure that construction crews do not affect a much larger area than the construction site. At this stage sites for the salvage and stockpiling of topsoil should be identified. In the interest of cost control, the overburden piles and soil stockpiles are usually located as close as possible to the extraction point. Frequently this is done without considering future expansion plans or changes to the processing facilities, thus creating the risk of future relocation of these stockpiles. The ideal is to place all overburden materials removed at mine opening in their final closure location, or as close as practicable to it.

Availability of soil materials is the key to successful rehabilitation the surface layer Topsoil salvaged during construction or expansion of mines should be stripped to remove the majority of the material suitable for supporting plant growth. In practice the thickness of useable soil materials varies considerably but at this location is expected to be approximately 1 meter thick. For the finalization of soil stripping scope of work, the pre-mining soil survey should be consulted to identify the material that will support growth and which will be worth salvaging.

Soils of different characteristics should be stockpiled separately to ensure that their characteristics are suitable for the drainage conditions they will encounter when the are replaced. At a minimum soils should be separated into three categories according to clay content, and into topsoil and subsoil horizons.

A detailed soil plan based upon the results of the pre-mining soil survey must be generated before mining or construction begins. The soils at Leiden are predominantly shallow yellow-brown structureless soil, which facilitate replication during the rehabilitation stage and at closure, except where this occurs in the wetland areas. Therefore disturbance (topsoil harvesting) from wetland areas should be avoided.

Where possible the stripping of soils should be done in a single action and utilise equipment that reduces the risk of compaction. Stockpiles should be located in a free draining locations so as to avoid them becoming water logged or being leached. Stockpiles should be clearly designated and demarcated to avoid unauthorised use of the soils and to limit contamination. If they do not vegetate naturally within a season they should be seeded to prevent erosion. (For more detail refer to sections 2-4 of the Chamber of Mines of SA Guidelines for the Rehabilitation of Mined Land.)

25.2.2 PHASE 2: MAKING SAFE

Following the conclusion of mining decommissioning the area would be cleaned up and the sections to be rehabilitated made safe. This involves the following:

- Removal of infrastructure and unused or unwanted equipment. No facilities will remain on site unless with the written approval of the post-mining land-owner, post-mining land user as per SDF projects, or relevant authority. This includes the removal temporary office structures and any associated ablution facilities as well as pipelines. as well as any waste that may still be stored at the Leiden temporary waste collection facility.
- Removal of rubbish from the Leiden temporary waste collection and storage facility for disposal at approved sites. Particular care will be required with residual toxic or hazardous materials including contaminated hydro-carbons, packaging or containers, although these volumes should be minimal.
- Removal of all services unless these are specifically required for post-mining land-use or have been requested by the post-mining land owner, who can demonstrate an ability to maintain them.
- Removal or burial of all concrete slabs, foundations, footings etc. unless these are required by the post-mining land-owner or have been designated and approved for post-mining use by the relevant authority.

- Backfilling of any pits, dams or similar excavations unless these are required for use by the post-mining land-owner or have been designated and approved for post-mining use by the relevant authority.
- Restricting or preventing public access by removal or closure of mine-specific access roads and tracks.

25.2.3 PHASE 3: LANDFORM DESIGN, EROSION CONTROL AND RE-VEGETATION

25.2.3.1 Landform Design & Erosion Control

The re-shaping and re-grading of an impacted site is essential for rehabilitation and closure to take place. Unless slopes and surfaces have been stabilized the effectiveness of subsequent rehabilitation and re-vegetation is greatly reduced and maintenance will be prolonged. Therefore the methodology utilised for final landform design will consider the following factors;

- Erosion potential of materials on site
- Recognition of pre-existing surface and groundwater flow patterns
- Alignment with existing topographical features
- A preference for shallow, less erodible slopes
- Slope angles and lengths to be visually compatible with the surrounding area and stable under local rainfall patterns and erosion processes.
- Recognition that unconsolidated materials from disturbed land will require greater protective measures to minimize erosion.
- Overburden depositories normally require a drainage density higher than existed prior to mining to compensate for the increase in the gradient of slopes and drainage channels. As a rule where run-off in concentrated into drains or diversion channels, individual catchment area of 2 hectares are required.
- Unless already naturally vegetated, slopes will be designed to reduce the velocity of run-off and long straight ridges and slope angles will be avoided. Slope angles will be less than 20 degrees, except for slopes constructed of non-erosive rock.
- Only where limitations prevent the construction of stable slopes will contour benches or similar erosion control measures be considered.
- The drainage pattern for the overall site will be planned as part of the overall land-scaping, with drainage patterns and densities of monitored during the operational phase on, and near site providing a guide to site requirements
- The entry of water runoff to the site will be limited through diversion channels and holding structures such as small dams.
- Where possible, rainfall infiltration will be encouraged, except on materials that have acid generating potential.

- Final site drainage will be directed internally towards the existing wetlands and surface water drainage paths.

Given the pre-mining ecology and drainage patterns, the final landform design will focus on re-creating the pre-mining topography to accommodate anticipated post-mining drainage patterns along the major drainage lines which will be located in the wetlands towards the south. As waste rock generation should essentially be limited to the volumes generated during the development of underground access to the coal seams, it is not anticipated that there will be a need to re-shape and vegetate a large spoils depository. Instead some of the material will find use as storm water, and access control berms and other construction purposes such as foundations and raising pads during the operational phase and should thus end up buried as part of demolition or land shaping.

25.2.3.2 Re-vegetation

Rehabilitation is designed to establish an adequate cover of non-erodible materials or vegetation so as to stabilize the site and prevent and control erosion to natural levels. As the majority of the land disturbed at Leiden will have been significantly sterilised and compacted by the mine structures around the decline shaft and its supporting structures as well as the beneficiation and haulage of coal on site, it must be assumed that following the removal of all infrastructure the soil will require amelioration to prevent its long-term sterilization. Thus prior to the placement of the stockpiled soils, the exposed surface should be ripped to a depth of at least 200mm. This should be done with agricultural rippers or dozer rippers to ensure free drainage and root penetration. Following this, overburden or other salvaged soils should be used to create a free-draining landform over the former mine complex (and the sealed decline shaft). Only then should the salvaged topsoil be placed over the area and an agricultural fertiliser applied prior to seeding.

Wherever vegetation has already established a cover of a density and diversity comparable to the surrounding landscape, no further re-vegetation or erosion control will be implemented. Beyond this the rehabilitation and re-vegetation of areas other than access portal will be rehabilitated and re-vegetated as follows:

- Existing culverts and storm water control infrastructure will be upgraded (using mainly gabions) to ensure its long-term effectiveness and its ability to handle a 1:50 year flood event.
- Existing pollution control dams will be maintained where they can be integrated into the long term pollution control infrastructure

Once all water management infrastructure has been put in place and all disturbed areas have been prepared and shaped, the establishment of vegetation can proceed on these areas. This should be planned in such a way that seeding takes place at a time of year that will enhance the germination success of the species used for re-vegetation. This applies irrespective of whether the area is being returned to forestry or to wilderness.

The species selected for the re-vegetation of each specific post-mining wilderness area will be informed by the species composition as determined by fauna and flora studies which form part of this document, in non-impacted, comparable areas on site. To ensure a steady supply of suitable specimens and to avoid denuding the surrounding countryside of indigenous seeds, Leiden could, as part of its CSI or SLP initiatives, establish a nursery operation with which to ensure a sustainable source of indigenous seeds and young plants to vegetate the areas marked for re-vegetation. This nursery could also serve as the source of young trees for those areas where the re-establishment of pre-mining eco-systems has been determined as not feasible or desirable (due to stakeholder input) and where low-intensity agriculture, grazing or forestry land uses are eventually agreed upon.

Re-vegetation can only take place during suitable seasons (end of winter, spring).

Concurrent with re-vegetation the removal of all remaining exotic vegetation left on the property is recommended. The plant material thus collected should be chipped and used as organic additive to particularly impacted soils or in areas where the re-establishment of wetlands is planned. The addition of this material increases the ability of rehabilitated soils to retain soil moisture and works against soil crust formation which can affect rainfall run-on/off.

25.2.4 PHASE 4: MONITORING, MAINTENANCE AND RELINQUISHMENT

Once the final landform design has been established and stabilized (with re-vegetation or otherwise) the mine will provide for a period of monitoring to verify the success or otherwise of the rehabilitation program. The length of the monitoring period will be determined in consultation with the appropriate regulators and would take the form of periodic inspections by contracted specialists, but is generally assumed to last for at least 3 years for issues other than ground water and possibly more than a decade for ground water. This applies even to the areas directly returned to forestry.

The parameters that may be monitored after rehabilitation should subject to agreement with the regulator, include the following:

- The continued safety of the site,
- Alignment of actual final topography to agreed planned landform.
- Depth of topsoil stripped and replaced.
- The establishment and growth of plants including the return of species not planted as part of re-vegetation, on the areas not returned to forestry
- The percentage of ground cover and species composition
- The return of native fauna (where eco-system restoration is intended)
- Soil fertility, pH and salinity
- Evidence of land erosion or land degradation
- The presence of vertebrate and invertebrate aquatic species identified in the EIA/EMP as indicator species,

- Surface water drainage systems and surface water quality
- Groundwater quality at agreed locations (including downstream)
- Condition of downstream ecosystems.

Maintenance that may be required in addition to rehabilitating any areas where initial vegetation establishment failed include:

- Fencing to control access by grazing animals onto rehabilitated areas, especially any re-constituted wetlands and the areas surrounding any re-established dams
- Pest and weed control
- Liming to control pH or heavy metals

Where reworking becomes necessary as a result of re-vegetation not performing adequately, this work will be scoped in consultation with the regulators. Sufficient funds will be allowed for this as part of the post-closure monitoring budget.

26 FINANCIAL PROVISION

For the calculation of the Leiden mine closure plan the master rates provided by the DMR for the calculation of the financial quantum adjusted for 2014 CPI were used. It must however be kept in mind that some infrastructure may be added to the existing site as the facility moves beyond supplying Eskom to also generating export quality coal. This may at some stage require a fundamental recalculation of the financial quantum for closure.

26.1 ANNUAL FORECASTED FINANCIAL PROVISION

Pertinent to the estimation of the closure cost liability are the following features with their approximate footprint and rehabilitation / component costs set out (numbers in brackets indicate spreadsheet category:

- Dismantling of crusher and platform (15 000 cubic meters@ R 11.97) R 179550 – (1)
- Access and haulage roads partly off-site (ca. 1km or 10 000 square meters @ R 29.86 / sq.m). R 298 600 – (3)
- Decline and ventilation shaft based upon a box cut of ca. 3 hectares (360 000 cubic meters @ R 89.60 m3) R 32 040 000 – (7)
- Temporary general waste collection and storage site (0.5 hectares@ R 333.87 / sq. m.) R 1 669 350 – (5)
- Land utilised for temporary overburden and topsoil storage (4 hectares @ R 92429 / ha) R 369 716 – (10)
- Carbonatious Stockpile/Coal Stockpile area (4 hectares @ R 145 321) R 581 284 – (8B)
- Return water and storage dams (2 hectares @ R 145 321/ha) R 290 642 – (8B)
- Stormwater control infrastructure (4 hectares@ R 92429 / ha) R 369 716 – (10)
- Wash bay, effluent separation, fuel storage and water recycling system facilities (2 hectares @ R 333.87 sq.m.) R 6 677 400 – (5)
- Explosives storage; (1.5 hectares @ R 92429/ha) R 138 644 – (10)
- Sewerage treatment plant; (0.5 hectare @ R 333.87 sq.m.) R 1 669 350 – (5)
- Plant offices, change rooms, store rooms and workshops, and other ancillary infrastructure (3 hectares @ R 333.87 sq.m.) R 10 016 100 – (5)
- Compacted land beyond other infrastructure, incl. area surrounding access portal (10 hectares/ R 92429 ha) R 924 290 – (10)
- Otherwise disturbed land (provision for on- and offsite impacts) (8 hectares @ R 92429 ha) R 739 432 – (10)
- Water management for entire site (1291 ha @ R 35 144 / ha) R 45 370 904 – (13)
- Post-closure monitoring and maintenance for entire site (1291 ha @ R 12 300 / ha) R 15 879 300 – (14)

This would amount to a net total of R 117 214 297. In addition, the DMR "Guideline Document for the Evaluation of the Quantum of Closure-Related Financial provision provided by a Mine", requires the following inclusions for the purposes of calculating the total mine closure liability.

- Preliminary & General, contractor site establishment -12% (subtotal R 14 065 716)
- Contingency – 10% (subtotal R 11 721 430)
- VAT – 14% (subtotal R 16 410 001)

This would result in a Clean Cost Closure Liability of R 117 214 297 and a Total Mine Closure Liability (incl. P&G, Contingency and VAT) of **R 159 411 444.**

26.2 CONFIRMATION OF AMOUNT TO BE PROVIDED

In terms of the MPRDA and the Income Tax Act, the financial provision for closure must be assessed annually in order for any additional infrastructure or negative impact to be incorporated into the financial provision costing during the annual assessment as the project progresses.

26.3 METHOD OF PROVIDING FINANCIAL PROVISION

In terms of Section 51(b) (v) and Regulation 53 and 54 of the MPRDA, Mashala is required to make financial provision for the rehabilitation of negative impacts associated with its activities under the mining right. In terms of said Act, the company is further required to determine the quantum of the financial provision for the cost of pre-mature closure, decommissioning and final closure and post-closure management of the residual and latent environmental impacts.

Once said closure quantum has been calculated, Mashala must begin the process of setting aside funds to ensure, that through annual (theoretically equal) contributions, the full amount required to cover de-commissioning, rehabilitation closure and post-closure activities will be provided for over a 30 year period or the life of mine, whichever is shorter. These funds must be set aside in a separate mine closure trust fund whose operation is governed by the Income Tax Act 58 of 1962 (as amended) Section 10 (1) (cH).

In addition, in terms of Regulation 53 (1) of the MPRDA, Mashala as the owner/operator must lodge a guarantee (in the form of a bank guarantee from a registered South African bank) in order to provide security against a closure funding shortfall in the case of un-planned or premature closure.

Finally Regulation 54 (2) of the MPRDA provides for the annual review of the financial quantum for mine closure. This review must be informed by any adjustments of the Life of Mine plans, revisions of the EMP and new legislative requirements. Depending upon the outcome of the review, annual contributions to the mine closure provision/ mine closure trust fund will be adjusted to ensure that sufficient funds are available for rehabilitation, decommissioning and closure of Leiden coal mine.

27 TECHNICAL SUPPORTING INFORMATION

The following appendices are included:

Appendix T - Closure, Rehabilitation and Final Land Use; and

Appendix U - Financial Provision.

28 CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT

28.1 AMOUNT REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT

The proposed Leiden Coal Mine will manage environmental impacts throughout the value chain of Mashala Resources (Pty) Ltd. The proposed mine will put in place mitigation measures to achieve the objectives and goals of impact management and rehabilitation as identified in this report. The direct operational budget for the financial year following approval will be determined in consultation with the DMR and a capital budget for the project provided for. Estimated costs for the implementation of specific mitigation measures where available are provided in the specialist reports.

28.2 AMOUNT PROVIDED FOR

The amount provided for to manage and rehabilitate the environment will be provided by the direct operational budget for the proposed mine and in consultation with the DMR.

29 UNDERTAKING SIGNED BY APPLICANT

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises EIA and EMP compiled in accordance with the guideline on the Departments official website and the directive in terms of sections 29 and 39 (5) in that regard.	
Full Names and Surname	Kenneth Douglas Hodge
Identity Number	521026505083

30 ENVIRONMENTAL IMPACT STATEMENT AND CONCLUSION

The proposed Leiden Coal Mine is located in the Mkhondo Local Municipality which is in great need of business investment and job creation. The commencement of the proposed Leiden Coal Mine will likely contribute to both business investment and job creation as well as improve business confidence in the area. As such, the project fits in well with the overall provincial economic structure, most notably in terms of employment and industry sector growth.

Despite the economic benefit of the proposed Leiden Coal Mine, the project is likely to result in several significant environmental impacts that will require ongoing management. In order to best manage these impacts it is the opinion of the EAP (which is supported by the various specialist consultants) that the most preferred development alternative is Alternative 3: Sensitivity Planning Approach.

Approval of Alternative 3 allows for both resource protection through the restriction of the operation to underground mining only and reduces the extent of impacts across the temporal and spatial scales. Furthermore it allows for the opportunity to undertake a mixed land use on the property whereby forestry operations, with certain restrictions, can continue on the surface and coal mining underground.

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