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Mukulu Mine
Environmental Impact Assessment and Environmental Management Programme

Submitted for an Application for a Mining Right in terms of Section 39 and of supporting Regulations 50 and 51 of the Mineral and Petroleum Resources Development Act, 2002, (Act No. 28 of 2002) (the Act)

Report

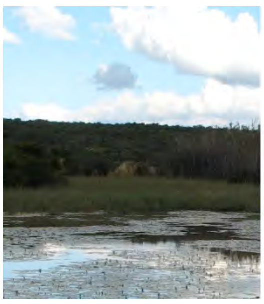
Version - Final

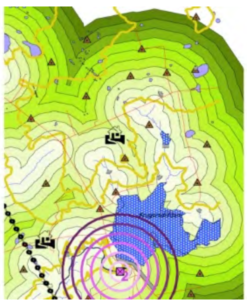
14 June 2012

Main Street 778 (Pty) Ltd

Project Number: 12-105

DMR Reference Number: NC (30)/5/1/1/2/10041MR

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EXECUTIVE SUMMARY

Project Background

Main Street 778 (Pty) Ltd (“Main Street”) is the holder of a prospecting right [(NC) 30/5/1/1/2/10041PR] granted in terms of Section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) over the farms Mukulu 265, Santoy 230, Belgravia 264, Olivewood 282, Tigerpan 266, Bergheim 229 and Epsom 285 in the Kuruman District of the Northern Cape Province.

A mining right application was lodged in November 2011 with the Department of Mineral Resources (DMR) with respect to the properties over which the prospecting right was held, to establish an underground manganese mine (referred to as the “Mukulu Mine”) approximately 8km west of Hotazel in the Northern Cape Province.

Main Street is a joint venture between Interplay Trading 89 (Pty) Ltd (“Interplay”), Ditswammung Mineral Resources Consortium (Pty) Ltd and China Manganese Limited. Interplay will be diverted to Atlasa Resources Corporation (Atlasa) (formerly Anooraq Resources Corporation) which is a black economic empowerment (BEE) platinum group metals (PGM) mining, exploration and development company.

Project Description

The surface infrastructure which is proposed for the Mukulu Mine will be located on the farm Mukulu 265. Three (3) twin vertical shafts are proposed on Mukulu 265, Olivewood 284 and Belgravia 264. The surface infrastructure will include a waste rock dump (for all three shafts), product stockpiles, Run of Mine (RoM) stockpile, railway loop and loading; powerlines (Eskom) and substation near the main plant; water pipelines for bulk potable water supply; a paste disposal facility (PDF); processing/mineral beneficiation plant; access and haul roads; as well as office buildings and workshops.

Full production of 1 million tonnes per annum (high grade manganese) will be attained from the Mukulu shaft early in the second year of production (2018) and will be maintained until 2025. Once the Olivewood shaft is phased in, the production will increase to 2 million tonnes per annum, then to 2.5 million tonnes per annum once the Belgravia shaft is phased in.

Environmental Authorisations

In order to establish the proposed Mukulu Mine, the following authorisations are required, and are in the process of being applied for:

- Mining Right in terms of Section 23 of the MPRDA;
- Environmental Authorisation for various activities listed in terms of Section 24 (2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The NEMA activities which are triggered by the proposed mine are listed under Regulations R544 and R545, and as such require an application for an Environmental Authorisation in the form of an EIA process. All activities under Notice 1 GN 544 which requires a Basic Assessment will be included as part of the full EIA process; and
- Water Use Licence for water uses listed under section 21 (b), (g) and (j) of the National Water Act, 1998 (Act No. 36 of 1998) (NWA).

Public Participation

The Public Participation Process (PPP) is a requirement of the EIA/EMP process and ensures that all relevant Interested and Affected Parties (I&AP's) are consulted and involved.

The PPP for this project during the MPRDA phase has included written communication with stakeholders (landowners, authorities and the public) in the form of Background Information Documents, site notices and advertisements, as well as landowner consultation meetings on Thursday, 10 May 2012 with Assmang Black Rock Mine (adjacent to the Mukulu Mine MRA and the private landowners within the Mining Right Area (MRA)). The PPP will continue throughout the project process specifically during the NEMA and NWA processes which are still to be undertaken.

Baseline Environmental Description, Impacts and Mitigation:

Climate

The Mukulu Mine area is situated high in the north-eastern part of the Northern Cape Province in the vicinity of the Kalahari Desert. The region is considered water scarce with low annual rainfall, most of which is received during summer. The prevailing wind direction is north-west.

<u>Geology</u>

The Kalahari Manganese Basin is situated within the Kuruman district of the Northern Cape Province and lies at approximately 1000 metres above sea level (masl). The MRA is located in the northern portion of the Kalahari Manganese Field (KMF). The KMF is an erosional basin spanning approximately 40km in the North-South dimension and 15 km in the East-West dimension. The regional strike in the study area is 330 degrees with a westward dip of around 7 degrees.

Main Impacts

The geology of the MRA will be altered due to mining.

Main Mitigation and Management Measures

No mitigation measures are possible, as mining permanently destroys the geological strata.

The mining operations will remain within the limits of the designated mining rights area.

<u>Topography</u>

The topography of the entire study area is generally flat and the general slope is in a north-easterly direction.

The proposed mining areas/resource blocks in the Mukulu Mine MRA are separated by a generally homogenous topography, which is mostly in the form of flat plains, with red sand dunes found throughout the area.

Main Impacts

- Change to natural topography.

Main Mitigation and Management Measures

- Keep the construction footprint as small as possible;
- Keep as much original landcover as possible; and
- Design mine infrastructure (berms, channels, stockpiles and dumps) to create the least impact on the topography as possible.

Soils, Land Use and Land Capability

Six (6) different soil forms are present in the MRA The soil forms identified include soils of the Hutton and Clovelly forms which are deeper than 1000mm and that correlate very well with the areas where Acacia erioloba grows and shallow soils that include a combination of Molopo and Coega forms where the topsoil or shallow B1-horizon is underlain by a hardpan carbonate horizon. Areas where depressions or pans were identified are associated with the Coega and Plooysburg soil forms which are not hydromorphic (wetland) soil forms and can be used for development purposes. Apart from the six soil forms, there are also additional areas where human activities have disturbed soil to such an extent that the original soil profiles can't be classified any longer. These areas are called anthropic soils.

The MRA area, which is to the east of the existing Assmang Black Rock Mine, is mainly used for extensive for cattle, sheep, goat and game farming. The game farming areas also have the potential to be developed into tourism destinations.

Although crop production may be possible from a soil capability perspective, there are climatic restrictions to agricultural potential, i.e. high evaporation and low rainfall in the region.

The entire area has grazing land capability with a capacity of 14 ha per large stock unit.

Main Impacts

- Loss of fertile topsoil layer;
- Soil compaction;
- Soil erosion;
- Chemical soil pollution;
- Changes in natural soil profile (soil landscape); and
- Loss of current land capability.

Main Mitigation and Management Measures

- Keep the construction footprint as small as possible;
- Construct storm water management measures prior to site clearance;
- Maintain grass cover for as long as possible, i.e. do not strip soils earlier than necessary;
- Strip soils during dry winter months to limit soil compaction;
- Use tracked vehicles on site rather than wheeled vehicles to minimize compaction;
- Ameliorate and re-vegetated soil stockpiles as soon after construction as possible;
- Limit the extent of hauls roads as much as possible;

- Monitor grass cover of the soil stockpiles (berms) in order to maintain a high basal cover; and
- Management of spillages by containing spills, remediating soils and monitoring thereafter.

Flora

The vegetation in the MRA corresponds to the Savanna Biome, which is the largest biome in southern Africa, covering about 46% of its area. The MRA represents a mixture of the Kalahari Plains Thorn Bushveld and the Kalahari Plateau Bushveld. The African savanna comprises more than 13 000 plant species, of which 8 000 are savanna endemics. Specifically, dry savannas have more than 3 000 endemic species.

The physiognomy and diversity exhibited by natural habitat within the study areas is regarded representative of the regional vegetation types. Extremely little degradation and transformation is noted on a local and regional scale. The vegetation of the study areas is in a primary climax status.

No 'Threatened' species were recorded during the survey period (winter assessment) in the study areas, which could be a reflection on the winter sampling period. Much of the natural habitat within the study area comprises primary climax status woodland habitat and the possibility that Red Data species might be present within the study area cannot be excluded without further studies.

Species included in the 'Declining' category, as well as provincially protected trees, forbs and geophytes were recorded within the MRA.

The proposed development, when viewed in isolation, will not affect the conservation status of floristic attributes adversely on a local or regional scale. The cumulative impact of numerous similar developments in the immediate area and on a regional scale, is however significant and should form the subject of a provincial and/ or municipal overview.

Main Impacts

- Direct impacts on flora species of conservation importance;
- Direct impacts on natural vegetation, sensitive or protected habitat;
- Direct impacts on ecological connectivity and ecosystem functioning;
- Indirect impacts on surrounding habitat;
- Cumulative impacts on SA's conservation obligations and targets;
- Cumulative increase in local and regional fragmentation / isolation of habitat; and

- Cumulative increase in environmental degradation, pollution.

Main Mitigation and Management Measures

- Limit the development footprint of the proposed development as far as possible;
- Implement a buffer zone of at least 30m between the edge of sensitive habitat and any surface disturbance;
- Prevent contamination of natural habitat from any source of pollution;
- Remove and relocate plant species of conservation importance that are present within development area;
- Prevent open fires outside of area designated for that purpose;
- Relocate any protected plants (under the authorisation of the necessary permits from the Department of Agriculture, Forestry and Fisheries);
- Limit the number of tracks developed for vehicles during construction;
- Dust suppression spraying of disturbed surfaces;
- Provide sufficient on-site ablution, sanitation, litter and waste management and hazardous materials management facilities during construction;
- Remove alien vegetation and preventing the proliferation of any invasive or exotic plants;
- Keep vegetation cover for as long as possible;
- Topsoil should be used for rehabilitation purposes;
- Ensure proper surface restoration and re-sloping in order to prevent erosion;
- Temporarily fence re-vegetated areas to prevent damage by grazing animals;
- Construct storm water management measures prior to site clearance.

<u>Fauna</u>

The results obtained from the faunal assessments clearly indicated the absence of numerous species that would be expected to aggregate in the region in the austral summer period.

The presence of 85 animal species was confirmed within the MRA: seven (7) insects, five (5) reptiles, fifty-one (51) birds, twenty-two (22) mammals, as well as thirty-six (36) invertebrate families. The 85 species found to occur in the study area included seven Red Data species, Fauna taxa recorded attest to the untransformed nature of the MRA. Most animals expected to occur in the area (given the geographical location of the study area as well as the size and diversity of terrestrial faunal habitats within the area investigated) were recorded. Kalahari animals such as Namaqua Sand Lizard, Red-billed Spurfowl, Cape Cobra, Namaqua Sandgrouse, Marico Sunbird, Damaraland Mole-rat and Bat-eared Fox are known to occur in the region.

Main Impacts

- Direct impacts on Red Data fauna species;
- Loss or Degradation of natural faunal habitat;
- The disruption of ecological connectivity and migration routes of larger, flightless animals as well as territorial infringement; and
- Direct impacts on common fauna species & interactions with structures and personnel.

Main Mitigation and Management Measures

- Limit all impacts to the approved development footprint;
- Implement a buffer zone of at least 30m between the edge of sensitive habitat and any surface disturbance;
- Construct storm water management measures prior to site clearance;
- Limit the number of tracks developed for vehicles during construction;
- No roads will be allowed within ecologically sensitive areas;
- No animal may be hunted, trapped, snared or captured for any purpose whatsoever;
- Vehicular traffic should not be allowed after dark in order to limit accidental killing of nocturnal animals;
- Implement speed limits within the MRA;
- Dangerous animals should be handled by a competent person; and
- No domestic pets should be allowed on the site.

<u>Wetlands</u>

The National Freshwater Ecosystem Priority Areas project (NFEPA) database indicates 2 large interdune pans as occurring on site. During the site visit undertaken in April 2012 it was however found that these so called “pans” indicated in the NFEPA database coincided with areas of shallow and exposed valley calcrete and that neither the soil nor the vegetation indicated these areas to be wetlands.

The vegetation of these calcrete valley floors is characterised by vegetation differing from the surrounding sand dunes, and was typically dominated by a number of small karroid shrubs. The presence of dryland species such as *Tarchonanthus camphoratus* scattered throughout the calcrete valley floors indicates that these areas cannot currently be considered wetlands areas. Further to the south of the MRA, around Kuruman, where pans are a common feature of the landscape, *Tarchonanthus camphoratus* is excluded from the pan basins and perimeters presumably based on soil wetness, indicating that these calcrete valley floors, though captured in the NFEPA database, cannot be considered wetland areas.

Main Impacts

No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact is expected.

<u>Surface Water</u>

The MRA is situated within a low rainfall region; average annual precipitation is approximately 324mm of which only 0.8mm (0.24%) ends up as run-off out of the catchments, augmented by the sandy nature of the soils facilitate infiltration and flat topography that prevent run-off.

The Ga-Mogara River is situated approximately 5km to the east of the site. This river drains into the Kuruman River situated approximately 3km to the north. Both these rivers are indicated to have an extremely intermittent flow period, only flowing subsequent to significant flash flood periods.

Approximately 1% of rainfall will run off and reach local river systems. The region contains large endoreic areas, where runoff is expected to seep into the earth or form temporal pools and be lost to evaporation.

Main Impacts

- Contamination of water resources due to contaminated runoff (low significance);
- Removal of animal watering pond before the development of the Belgravia shaft;
- Contamination from dirty runoff.

Main Mitigation and Management Measures

- Construction of storm water management infrastructure prior to vegetation clearance;
- Storm water management measures will only be rehabilitated after decommissioning when the mine is considered non-polluting;

- All contaminated water to be contained within dirty water dams. The mine will be a zero discharge facility; and
- Management of spillages of hydrocarbons or chemical immediately by containing the spill and remediating the area.

Groundwater

Most of the groundwater investigation was limited to the farm Mukulu 265, on which mining is proposed to start in 2018. Three (3) boreholes were drilled on Mukulu. Only one borehole had water strikes with a blow-out yield, whilst the remaining boreholes were dry. The monitoring borehole BH 2 underwent constant rate aquifer testing.

The boreholes identified within the MRA during the hydrocensus (33 boreholes) are used mainly for stock watering and domestic purposes. No springs were identified within the study area.

Two (2) aquifers were defined at Mukulu:

- The upper perched, primary/intergranular aquifer. This lower thick red clay layer with an average thickness of 30 m acts as an aquiclude;
- The underlying lithologies of the Transvaal Supergroup can be classified as the secondary aquifer which has already been dewatered to a certain extent due to existing underground mining activities.

The groundwater flow direction correlates with the topography with the general flow direction towards the north-east.

A total of fifteen (15) groundwater samples were analysed and the results indicated the dominant groundwater type for the area was sodium/bicarbonate water with calcium and magnesium in similar ratios. The chemistry results of the newly-drilled borehole (BH 2) indicated that it was contaminated with nitrate (NO_3) and sulphate (SO_4).

The results of geochemical analysis indicate that acid mine drainage (AMD) should not be expected over the long-term. Very few dissolved metals are expected to be present in neutral to alkaline seepage from the mine, except for aluminium (Al), iron (Fe) and manganese (Mn). Under slightly acidic conditions, manganese will significantly leach out from the rock material. Arsenic (As) may also leach out, but only in small quantities from the rock. It is not foreseen that it will reach non-compliant concentrations.

The numerical groundwater flow model indicated that no observed dewatering of the perched aquifer is likely to occur, provided they are not hydraulically connected. The deeper aquifer will be dewatered due to the proposed underground mining activities. The extent of the simulated dewatering cone, after 20 years of mining, is unlikely to affect any private groundwater users. However, this impact must be seen as a cumulative impact as the neighbouring mines also contribute to the regional dewatering cone that has developed and will extend over time.

No significant impact on the groundwater quality is likely, however some minor contaminant plumes may emanate from surface infrastructure. The risk posed by contamination of groundwater by the proposed mining is likely to be low.

Main Impacts

The drawdown of groundwater levels as a result of mine dewatering

Contamination of groundwater due to spills of hydrocarbons or chemicals

Main Mitigation and Management Measures

- All dewatered water will be stored for re-use at the mine;
- A groundwater monitoring programme will be implemented before construction (to establish the baseline conditions) and will continue until mine closure is obtained.
- The groundwater model must be updated once more groundwater data is available and as soon as the underground mine plan for the Olivewood and Belgravia areas is completed;
- Predicative modelling will help to determine if any groundwater users will be negative impacted.
- An open channel of communication will be established to ensure that surrounding farmers have the opportunity to raise any potential concerns;
- Should and impact be determined on the groundwater, an independent groundwater specialist will be appointed to assess the cause and extent of the impact. Should the impact be mine related the mine will enter into negotiations with the landowner, together with the DWA to determine a way forward.

<u>Air Quality</u>

No baseline air quality investigation was undertaken. However, the existing Assmang Black Rock Mine adjacent to the MRA has monitored dust fallout at the mine since 1999. This monitoring system was expanded towards the end of 1999 to include two baseline sites located in Kuruman and van Zylsrus.

The dust monitoring conducted to date indicates that the dust levels are on average in the order of 2-3 μg/m^3 on the mine site. The dust levels in Kuruman and van Zylsrus are average approximately 0.5 to μg/m^3. However, the manganese levels in dust are higher at the on-mine monitoring sites. The maximum annual threshold for manganese in total suspended particulate samples (>SP) is 100μg/m^3, which is well above levels recorded anywhere, on the Assmang properties.

Main Impacts

Creation of dust due to vegetation clearance, establishment of infrastructure, use of haul roads and stockpiling of materials

Main Mitigation and Management Measures

Limit activities to within the demarcated construction footprint as far as possible.

- Maintain grass cover for as long as possible, i.e. do not strip soils earlier than necessary;
- Implement dust suppression spraying; and
- Implement dust fallout monitoring programme.

<u>Heritage and Cultural</u>

Eleven (11) sites of cultural and historical significance were identified within the MRA.

- The three graveyard sites found (Site No. 2, 3 and 6) is of a high cultural significance. Exhumation is not recommended as there only will be a secondary impact;
- Site No. 9 (outbuildings on Tigerpan 266) and 10 (shooting range on Mukulu 265) are of a low cultural significance and may be demolished if necessary;
- Sites No. 1, 4, 5, 7, 8 and 11 comprise old houses, wagon houses, a school building, and outbuildings. These are all similar each other represent the architecture of the Kalahari. Although not very unique in this region, it is unique of this part of the country. The buildings should therefore be maintained;
- Site 1 is a very good example of this limestone architecture. It is therefore proposed that this site be maintained and preserved to serve as an example of this Kalahari farm architecture.

Based on the mine plan, all the sites identified are outside of the direct area of impact. There is however a secondary impact and therefore mitigation is needed.

Due to the limited access on Santoy, Portion 0, it is possible that all cultural sites may not have been identified. Also the subterranean presence of archaeological and/or historical sites, features or artefacts are always a distinct possibility.

Main Impacts

- Impacts on graves at Site No. 2,3 and 6 due to blasting and dust creation; and
- Impacts on buildings at Sites No.1, 4, 5, 7, 8, 11 due to blasting and dust creation.

Main Mitigation and Management Measures

- Compile heritage management plan for the management of grave sites;
- Grave sites should be fenced in properly, maintained, managed and preserved. Access to possible descendants should be allowed; and
- Monitor heritage sites within a 1km radius of where the blasting activities take place.

Noise

No baseline noise studies have been carried out to determine the contribution of the mine to the local noise levels. The surrounding land is however largely rural in nature and base noise levels can be expected to be low.

Main Impacts

Noise will be created during the construction, operation and decommissioning phases of the project. This impact will also be cumulative due to the existing Assmang Black Rock Mine.

Main Mitigation and Management Measures

- Limit construction activities to the daytime;
- Ensure that vehicles are properly maintained;
- When deciding on vehicles for the construction activities consider noise parameters;
- Include noise reduction technology on vehicles where possible.

Traffic

No baseline traffic assessments were conducted for this process. Main Street 778 will make use of the existing road network for the duration of the construction period; where after product will be transported via railway system to the market.

The proposed mine will lead to an impact on the roads and transport facilities within the proximity of the site. The mine will therefore be required to contribute towards the upkeep of the roads on which they operate.

Main Impacts

- Increased traffic on roads due to the use thereof by construction vehicles, truck carrying building materials and vehicles transporting workers to and from the mine on a daily basis (operational phase).

Main Mitigation and Management Measures

- Limit construction activities to the daytime;
- Use establishment routes as far as possible;
- Ensure that drivers obey all the rules of the road;
- Ensure an open channel of communication with the surrounding road users to act proactivity on possible issues;
- Consult with the relevant roads agency to determine whether the mine has to contribute to road maintenance or alterations due to increase traffic on the roads;
- The access to the mine form the main roads will be designed in such a way as to fulfil the relevant roads agency requirements; and
- Clear signage will be erected to warn road users of heavy vehicle presence.

<u>Socio-economic Conditions</u>

The Northern Cape Province is the largest province in South Africa with a land area the size of 361 830 km^2 and a population density of 2 persons per every km^2. Prominent languages include Afrikaans, English, Nama, SeTswana and Xhosa. The MRA is located the John Taolo Gaetswe District Municipality (DM), which is one of five (5) DMs in the province.

The John Taolo DM is divided into four (4) Local Municipalities (LM). The MRA is located within the jurisdictional area of the Joe Morolong (formerly Moshaweng LM);

The population of the Joe Morolong LM decreased dramatically over the 1996 to 2008 time period, only slightly increasing again in 2009 and 2010 to just above 74 000 people.

A large percentage (54.71%) of the Joe Morolong LM population has not obtained any form of schooling. Only 0.78% of the population achieved an academic level higher than Grade 12.

The Joe Morolong LM employment rate decreased dramatically after 2003, reaching the lowest level in 2007. According to the A total of 75% of the district's population has no recordable income.

According to the Joe Morolong LM IDP (2011/2012) the municipality is "faced with severe economic challenges". The area is poverty-stricken and faces harsh realities of chronic unemployment and [has] a huge dependency on government grants".

Main Impacts

- Demographic processes:
  - In migration;
  - Presence of temporary workers;
- Economic processes:
  - Waged labour;
  - Conversion and diversification of economy;
- Geographic processes:
  - Conversion and diversification of land use;
  - Enhanced transport and rural accessibility;
- Emancipatory and empowerment processes:
  - Capacity building;
- Socio-cultural processes:
  - Deviant social behaviour;
  - Health and social well-being;
  - Quality of the living environment;
- Cultural impacts:
  - Family and community impacts; and
- Institutional, legal, political and equity impacts:
  - Gender relations.

Main Mitigation and Management Measures

- Clearly communicated employment criteria should be communicated to the community in advance (e.g. in newspapers, community forum notice boards, etc);
- Employ local labour should be employed as far as possible;
- Do not allow accommodation on site;
- Informal traders must not be allowed to congregate outside the construction site;
- Chemical latrines or ablution facilities must be provided to workers in close proximity to the site;
- Provide employees with adequate health support for work-related health problems;

- Skills development opportunities should be granted to community members and local job seekers, where needed;
- Capture all project relevant skills in the project area on a database;
- Develop a Recruitment Manual to include a list of employment opportunities that will become available and provide guidelines on procedures to be followed by employment seekers;
- Establish an employment information desk to assist with the day to day management of project related labour issues;
- Identify and maximise on appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force;
- Ensure that contractors use local labour as far as possible;
- Ensure that local businesses, especially those of Historically Disadvantaged Individuals (HDI), women and of Small, Micro and Medium Enterprises (SMMEs) get allocated the maximum appropriate share of project related business opportunities;
- Establish landowner forum/environmental committee to consult with affected parties;
- Use local suppliers as far as possible;
- The mine should, in liaison with the relevant Roads and Traffic Department, assist with the regular maintenance of the roads frequently used by construction and mine traffic; and
- Management of environmental impacts through the strict adherence to the approve EMP.

Monitoring of Impacts

The following monitoring will be undertaken to determine the impact of the proposed mine on the environment:

- Groundwater monitoring: Groundwater levels (quantity) and quality will be monitored monthly. This monitoring will begin prior to construction to establish the baseline conditions and to identify the changes caused by the mine over time;
- Monitoring of dirty water dams will be undertaken monthly to ensure that the water quality stored in these dams does not exceed the conditions as stipulated in the WUL:
- Vegetation and soil monitoring of rehabilitated areas: this will be undertaken following construction activities and after the decommissioning and rehabilitation phase.

Motivation for the Project

The proposed Mukulu Mine, if developed will create both negative and positive impacts. The negative impacts will be prevented, mitigated and managed through the implementation of the measures set out in this EIA/EMP. The EIA/EMP furthermore includes proposed measures to enhance positive impacts. The benefits of the proposed project include:

- Job creation over the life of mine (project LoM of 29 years);
- Positive contribution to the economy of the district municipality, Northern Cape Province as well as the national economy;
- The creation of procurement opportunities for local entrepreneurs (contractors, suppliers, transport providers, etc.); and
- The establishment and upgrading of infrastructure within the project area.

Recommendations

The following recommendations are made with respect to the specialist studies, EMP and the project planning:

- Undertake a detailed mining plan for the proposed underground operations to be accessed via the Olivewood and Belgravia shafts;
- Update the groundwater model to determine the impacts of the Olivewood and Belgravia underground mining activities on the groundwater resources of the area, as well as to confirm what the post-closure impacts of the entire mining operation will be;
- Conduct a Geotechnical Investigation to determine the risk of subsidence on the farm Mukulu 265 during mining operations;
- Conduct a summer (December/January) Terrestrial Biodiversity survey within the project are to augment the results of the current results;
- Undertake an EIA to apply for a Waste Management License for the required sewage treatment plant; and
- Apply for any required rezoning of the proposed MRA area.

CHECKLIST IN TERMS OF REGULATION 50 AND 51 OF GOVERNMENT NOTICE 26275 OF MPRDA

This document has been compiled in terms of Section 39 and of Regulations 50 and 51 of the Mineral and Petroleum Resources Development Act, 2002, (Act No. 28 of 2002). The Department of Mineral Resources (DMR) Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) template states the following:

"All applicants for mining rights are herewith, in terms of the provisions of Section 29 (a) and in terms of Section 39 (5) of the Mineral and Petroleum Resources Development Act, directed to submit an environmental Impact Assessment, and an Environmental Management Programme strictly in accordance with the subject headings herein, and to compile the content according to all the sub items to the said subject headings referred to in the guideline published on the Departments website, within 30 days of notification by the Regional Manager of the acceptance of such application."

For ease of reference the checklist below has been provided. All subject headings are furthermore included under each chapter of the document.

REGULATION 50 (a).	**REPORT REFERENCE**
1. Description of the baseline environment	
1.1. Concise description of the environment on site relative to the environment in the surrounding area.	Chapter 2
1.2. Concise description of each of the existing environmental aspects both on the site applied for and in the surrounding area which may require protection or remediation.	Chapter 2
1.3. Concise description of the specific land uses, cultural and heritage aspects and infrastructure on the site and neighbouring properties/farms in respect of which the potential exists for the socio-economic conditions of other parties to be affected by the proposed mining operation.	Chapter 2

1.4. Annotated map showing the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms.	Figure 1.2, Figure 2.7, Figure 2.8, Figure 2.10, Figure 2.13, Figure 2.16 and Figure 2.21
1.5. Confirmation that supporting documents in the form of specialist studies are attached as appendices.	Chapter 14
2. The proposed mining operation.	
2.1. The mineral to be mined	Chapter 3
2.2. The mining method to be employed at the level of opencast, underground, stoping, stooping, total extraction, bord and pillar, block caving, shrinking, dredging, pumping, monitoring, etc. and provide a concise description of the intended magnitude thereof, in terms of volumes, depth and aerial extent.	Section 3.3.1
2.3. List of the main mining actions, activities, or processes, such as, but not limited to, access roads, shafts, pits, workshops and stores, processing plant, residue deposition sites, topsoil storage sites, stockpiles, waste dumps, access roads dams, and any other basic mine design features.	Chapter 3
2.4. Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes as required to calculate the financial provision in accordance with the Department's published guideline. (Reg. 51 (b) (v)).	Figure 3.1
2.5. Listed activities (in terms of the NEMA EIA regulations) which will be occurring within the proposed project.	Table 1.3
2.6. Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the implementation of these actions, activities or processes and infrastructure.	Section 6.1
2.7. Confirmation if any other relevant information is attached as appendices.	List of Appendices and Chapter 14
3. The potential impacts	
3.1. List of the potential impacts, on environmental aspects separately in respect of each of the aforesaid main mining actions, activities, processes, and activities listed in the NEMA EIA regulations.(include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7
3.2. List of all potential cumulative environmental impacts.	Chapter 7
3.3. State specifically whether or not there is a risk of acid mine drainage or potential groundwater contamination associated with the mineral to be mined. (If such a risk is associated with the mineral to be mined provide a summary of the findings and recommendations of a specialist geo-hydrological report in that regard).	Section 7.3.3
REGULATION 50 (b)	

4. The alternative land use or developments that may be affected	
4.1. Concise description of the alternative land use of the area in which the mine is proposed to operate.	Chapter 2
4.2. List and description of all the main features and infrastructure related to the alternative land uses or developments.	Chapter 3
4.3. Plan showing the location and aerial extent of the aforesaid main features of the alternative land use and infrastructure related to alternative land developments identified during scoping.	Figure 1.2
5.The potential impacts of the alternative land use or development	
5.1. List of the potential impacts of each of the aforesaid main features and infrastructure related to the alternative land use or development and related listed activities.	N/A
5.2. Description of all potential cumulative impacts of the main features and infrastructure related to the identified alternative land uses or developments.	N/A
REGULATION 50 (c)	
6. Identification of potential social and cultural impacts.	
6.1. List of potential impacts of the proposed mining operation on the socio- economic conditions of other parties' land use activities. . (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Table 7.6, Table 7.17 andTable 7.21
6.2. Description of the cultural aspect that will potentially be affected, and describe the potential impact on such cultural aspect. (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable).	Chapter 7
6.3. Description of heritage features and the potential impact on such heritage feature. (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable).	Chapter 7
6.4. Quantification of the impact on the socio-economic conditions of directly affected persons, as determined by the findings and recommendations of a specialist report in that regard.	Chapter 7
6.4.1. The amount of the quantified potential impact on property or infrastructural assets.	Chapter 7
6.4.2. State the amount of the quantified potential impact on commercial, economic or business activity which will be impacted upon as a result of the mining activity.	Chapter 7
6.4.3. The sum of the amounts, referred to in paragraphs 6.6.1 and 6.6.2 above.	Chapter 7
7. Assessment and evaluation of potential impacts.	
7.1. List of each potential impact identified in paragraphs 3 and 6 above. (Include all the items to be included in the list referred to in the concomitant Chapter of the guideline posted on the official website of the Department).	Chapter 7

7.2.Concomitant impact rating for each potential impact listed in paragraph 7.1 above in terms of its nature, extent, duration, probability and significance.(Provide a definition of the criteria used for each of the variables used for rating potential impacts and ensure that the potential impacts are rated specifically with the assumption that no mitigation measures are applied).	Chapter 7
7.3. Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the potential impacts rated.	Chapter 7
REGULATION 50 (d)	
8. Identification of the alternative land uses which will be impacted upon. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 4
9. Listed results of a specialist comparative land use assessment. (Refer to the concomitant section of the guideline posted on the official website of the Department and attach the specialist study as an appendix).	Chapter 4
REGULATION 50 (e)	
10.List of all the significant impacts as identified in the assessment conducted in terms of Regulation 50 (c) (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7
REGULATION 50 (f)	
11. Identification of interested and affected parties. (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report).	Chapter 5
12. The details of the engagement process. (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report and any further consultation since the compilation of the scoping report).	Chapter 5
13. Details regarding the manner in which the issues raised were addressed. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)	Chapter 5
REGULATION 50 (g)	
14. The appropriate mitigatory measures for each significant impact of the proposed mining operation.	
14.1. Adequacy of predictive methods utilised.	Section 12.1
14.2. Adequacy of underlying assumptions.	Section 12.2
14.3. Uncertainties in the information provided.	Section 12.3
REGULATION 50 (h)	
15. Arrangements for monitoring and management of environmental impacts.	
15.1. List of identified impacts which will require monitoring programmes.	Chapter 7
15.2. Functional requirements for the said monitoring programmes.	Chapter 8
15.3. Roles and responsibilities for the execution of the monitoring programmes.	Chapter 8

15.4. Time frames for monitoring and reporting.	Section 8.6
REGULATION 50 (i)	
16. Technical and supporting information. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	List of Appendices and Chapter 14
ENVIRONMENTAL MANAGEMENT PROGRAMME	
REGULATION 51 (a)	
1. Description of environmental objectives and specific goals for mine closure.	
1.1. Environmental aspects that describe the pre-mining environment.	Chapter 2
1.2. Measures required to contain or remedy any causes of pollution or degradation or the migration of pollutants, both for closure of the mine and post-closure.	Chapter 7
2. Description of environmental objectives and specific goals for the management of identified environmental impacts emanating from the proposed mining operation. (As informed by the information provided in the EIA in terms of Regulation 50 (h)).	
2.1. List of identified impacts which will require monitoring programmes.	Chapter 7
2.2. List of the source activities that are the cause of the impacts which require to be managed.	Chapter 3
2.3. Management activities which, where applicable, will be conducted daily, weekly, monthly, quarterly, annually or periodically as the case may be in order to control any action, activity or process which causes pollution or environmental degradation.	Chapter 7
2.4. The roles and responsibilities for the execution of the monitoring and management programmes.	Section 8.6
3. Description of environmental objectives and specific goals for the socio-economic conditions as identified in the social and labour plan. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Section 6.2
4. Description of environmental objectives and specific goals for historical and cultural aspects.	
4.1. Environmental objectives and goals in respect of historical and cultural aspects identified in specialist studies conducted during the EIA phase.	Section 6.2
REGULATION 51 (b) – Outline of the implementation programme	
5.The appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspect in each phase of the mining operation, as follow	
5.1. Actions, activities or processes, including any NEMA EIA Regulation listed activities, which cause pollution or environmental degradation. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7 & Table 1.3

5.2. Concomitant list of appropriate technical or management options chosen to modify, remedy, control or stop any action, activity, or process which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects as identified. (Attach detail of each technical or management option as appendices).	Chapter 7
6. Action plans to achieve the objectives and specific goals contemplated in Regulation 50 (a).	Chapter 7
17. Time schedules of deadlines for each action to be undertaken to implement each technical or management option chosen. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7
7. Procedures for environmentally related emergencies and remediation (An environmental emergency plan that includes all the items referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 9 & Appendix D
8. Planned monitoring and environmental management programme performance assessment.	
8.1. Description of planned monitoring of the aspects of the environment which may be impacted upon. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 8
8.2. Provide a description as to how the implementation of the action plans contemplated in Regulation 51 (b) (ii) as described will be monitored as described in paragraph 6 of the EMP will be monitored.	Chapter 8
8.3. Frequency of proposed reporting for assessment purposes.	Chapter 8
9.Financial provision in relation to the execution of the environmental management programme:-	
9.1. Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes anticipated. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department)	Figure 3.1
9.2. Annual forecasted financial provision calculation (Refer to the concomitant section of the EIA and EMP guideline).	Chapter 10 and Appendix E
9.3. Confirmation of the amount that will be provided should the right be granted.	Chapter 10 and Appendix E
9.4. The method of providing financial provision contemplated in Regulation 53.	Chapter 10 and Appendix E
10. Environmental Awareness Plan (Section 39 (3) (c)) (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 9 and Appendix D
11. Attachment of specialist reports, technical and supporting information. (Provide a List)	List of Appendices and Chapter 14

12. SECTION 39 (4) (a) (iii), Capacity to manage and rehabilitate the environment (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department.	Chapter 10 and Appendix E
13. UNDERTAKING	
13.1. The Environmental Management Programme will, should it comply with the provisions of section 39 (4) (a) of the Act and the right be granted, be approved and become an obligation in terms of the right issued. As part of the proposed Environmental Management Programme, the applicant is required to provide an undertaking that it will be executed as approved and that the provisions of the Act and regulations thereto will be complied with.	Chapter 15

CONTENTS PAGE

LIST OF FIGURES

LIST OF PHOTOS

LIST OF TABLES

LIST OF APPENDICES

1 BACKGROUND AND INTRODUCTION

1.1 Background

Main Street 778 (Pty) Ltd (Main Street) is a joint venture between Interplay Trading 89 (Pty) Ltd (Interplay) (which owns a 46.5% share), Ditswammung Mineral Resources Consortium (Pty) Ltd (which owns a 45.5% share) and China Manganese Limited (which owns a 3% share).

Interplay will be diverted to Atlasa Resources Corporation (Atlasa) (formerly Anooraq Resources Corporation) which is a black economic empowerment (BEE) platinum group metals (PGM) mining, exploration and development company. Atlasa controls and operates the Bokoni Platinum Mine, located on the eastern limb of the Bushveld Complex, and maintains a controlling interest in the Ga-Phasha Project, located adjacent to Bokoni, and the Boikgantsho and Kwanda Projects (Refer to Figure 1.1).

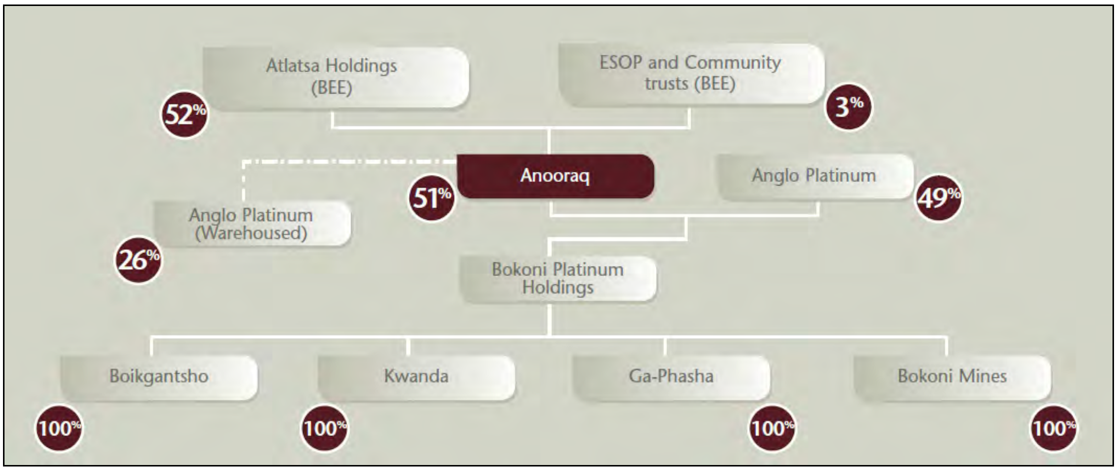


Figure 1.1 Atlasa Company Structure

Main Street is the holder of a prospecting right [(NC) 30/5/1/1/2/10041PR] granted in terms of Section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 22 of 2002) (MPRDA) over the farms Mukulu 265, Santoy 230, Belgravia 264, Olivewood 282, Tigerpan 266, Bergheim 229 and Epsom 285 in the Kuruman District of the Northern Cape Province.

The prospecting right, which expired on 11 December 2012, was ceded to Main Street by virtue of a notarial deed of cession executed on behalf of Interplay Trading 89 (Pty) Ltd, Ditswammung Mineral Resources Consortium (Pty) Ltd and Main Street on 3 October 2011.

A mining right application was lodged in November 2011 with the Department of Mineral Resources (DMR) with respect to the properties over which the prospecting right was held to establish an underground manganese mine (referred to as the "Mukulu Mine") in the vicinity of Hotazel in the Northern Cape Province. The DMR issued an acceptance letter on 15 December 2012. Main Street was instructed to submit a Scoping Report which was submitted on 27 January 2012 (after receiving an extension from DMR).

Main Street consulted, in writing, with Assmang Ltd regarding the properties within the Mukulu Mine area which are under Assmang ownership. Main Street also consulted with the Land Claims Commission in writing. The proof of this consultation was submitted as an Appendix to the Scoping Report.

After the appointment of Ezendalo Legal Solutions CC and GCS (Pty) Ltd (the Consultants) (Refer to Section 1.5.6) to undertake the environmental baseline investigation and environmental authorisation applications, the need for a more intensive consultation process was identified. This consultation process was undertaken by means of telephone calls, the submission of Background Information Documents to landowners, a newspaper advertisement, site notices and a landowner consultation meeting (Refer to Section 5).

1.2 Brief Project Description

Main Street intends to establish an underground manganese mine (Mukulu Mine) located 8km west of the town of Hotazel in the Northern Cape Province.

Three mineral resource blocks have been identified: the first is on Mukulu 265, the second across Olivewood 282, Espom 285 and Tigerpan 266, and the third on Santoy 230 and Belgravia 264. The estimated life of mine is 29 years.

At this stage, it is anticipated that underground mining will be undertaken. The bord and pillar mining method will be utilitsed.

The surface infrastructure, which will be located on the farm Mukulu 265, will include, but is not limited to: access and haul roads; railway loop and loading station (linked to the existing private railway line or to the Transnet railway line between Hotazel and Port Elizabeth); powerlines (Eskom) and substation near the main plant; water pipelines for bulk potable water supply; a paste disposal facility (PDF); processing/mineral beneficiation plant; twin vertical shaft systems on Mukulu 265, Olivewood 284 and Belgravia 264; waste rock dumps at each shaft; conveyors between each shaft and the Run of mine (ROM) Stockpile and office buildings and workshops.

The proposed surface infrastructure, mining method, production schedule, etc. are discussed in detail under Section 3 of this report.

1.3 Contact Details

The applicant is Main Street 778 (Pty) Ltd, a joint venture between Interplay Trading 89 (Pty) Ltd (Interplay) (with a 46.5% share), Ditswammung Mineral Resources Consortium (Pty) Ltd (with a 45.5% share) and China Manganese Limited (with a 3% share). The relevant contact details of the applicant are presented in Table 1.1.

Table 1.1 Applicant Contact Details

Name of Applicant	Main Street 778 (Pty) Ltd
Company Registration Number	200902077507
Contact Person	Bava Reddy
Physical Address	4th Floor, 82 Grayston Drive, Off Esterhysen Lane, Sandton
Postal Address	4th Floor, 82 Grayston Drive, Off Esterhysen Lane, Sandton
Telephone	(011) 779 6800
Fax	(011) 883 0836
Email	bava@atlasa.com

1.4 Description of Land

The Mukulu Mine Mining Right Area (MRA) is located approximately 8km west of the town of Hotazel, within the Joe Morolong Municipality (formerly Moshaweng) in the Northern Cape Province. The Moshaweng Local Municipality forms part of the John Taolo Gaetswe District Municipality.

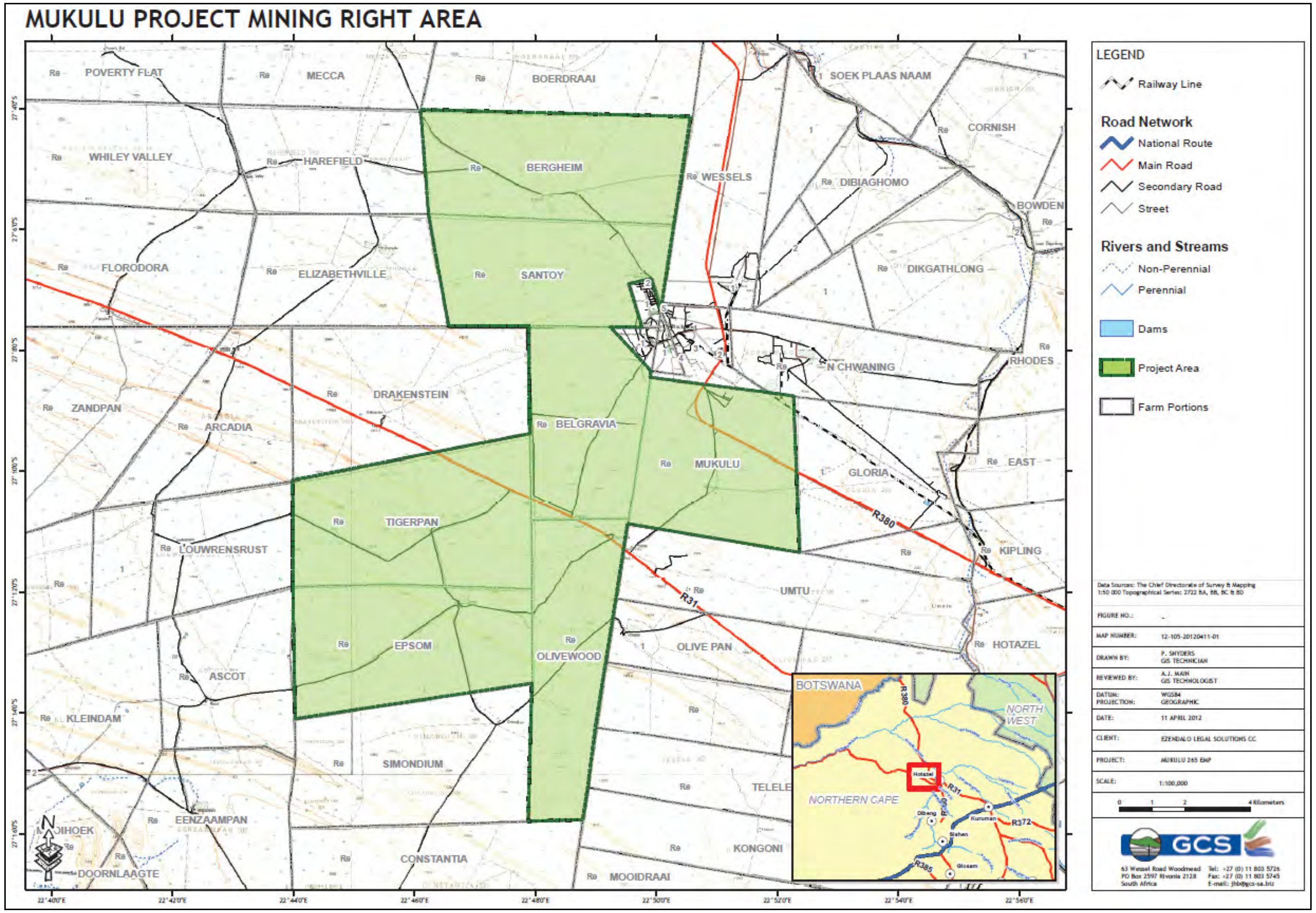
The MRA is in the vicinity (to the west) of the Assmang Manganese Black. Assmang is the owner of five (5) of the farm portions which comprise the Mukulu Mine MRA. The locality of the Mukulu Mine areas is shown in Figure 1.2.

The MRA comprises seven (7) farms, namely, Mukulu 265, Santoy 230, Belgravia 264, Olivewood 282, Tigerpan 266, Bergheim 229 and Epsom 285 in the Kuruman Registration Division. Three mineral resource blocks have been identified: the first is on Mukulu, the second across Olivewood, Espom and Tigerpan, and the third on Santoy and Belgravia. The property details for the MRA obtained from the government deeds website (www.deeds.gov.za) are described in Table 1.2.

Table 1.2 Mukulu Mine Property Details

FARM DESCRIPTION	EXTENT	TITLE DEED NUMBER	PROPERTY OWNER ON TITLE DEED
Mukulu 265, Kuruman RD	Unknown*	T288/1956	ASSMANG Ltd
Belgravia, 264, Kuruman RD, Portion 0 (Remaining Extent)	2008.5125M[1]	T303/1953	ASSMANG Ltd
Belgravia, 264, Kuruman RD, Portion 1	100.0042M[1]	T540/1940	ASSMANG Ltd
Epsom 285, Kuruman RD, Portion 0 (Remaining Extent)	1602.9073 ha	T5/1953	Jacobus Johannes Francois Theart and Maria Alida Theart
Epsom 285, Kuruman RD, Portion 1	685.2808 ha	T4334/1998	Kampher Family Trust
Olivewood 282, Kuruman RD	1846.3276 ha	T421/1993	Jacobus Johannes Francois Theart
Santoy 230, Kuruman RD, Portion 0 (Remaining Extent)	1935.2177 ha	T3152/2009	Johan Christiaan Lamprecht and Christa Alida Lamprecht
Santoy 230, Kuruman RD, Portion 1	100.0009M[1]	T542/1940	ASSMANG Ltd
Tigerpan 266, Kuruman RD	2585.9001 ha	T2031/1995	Petrus Albertus van der Merwe
Bergheim 229, Kuruman RD	2300.1053 ha	T705/1966	Manganese Mine of SA Ltd ASSMANG Ltd

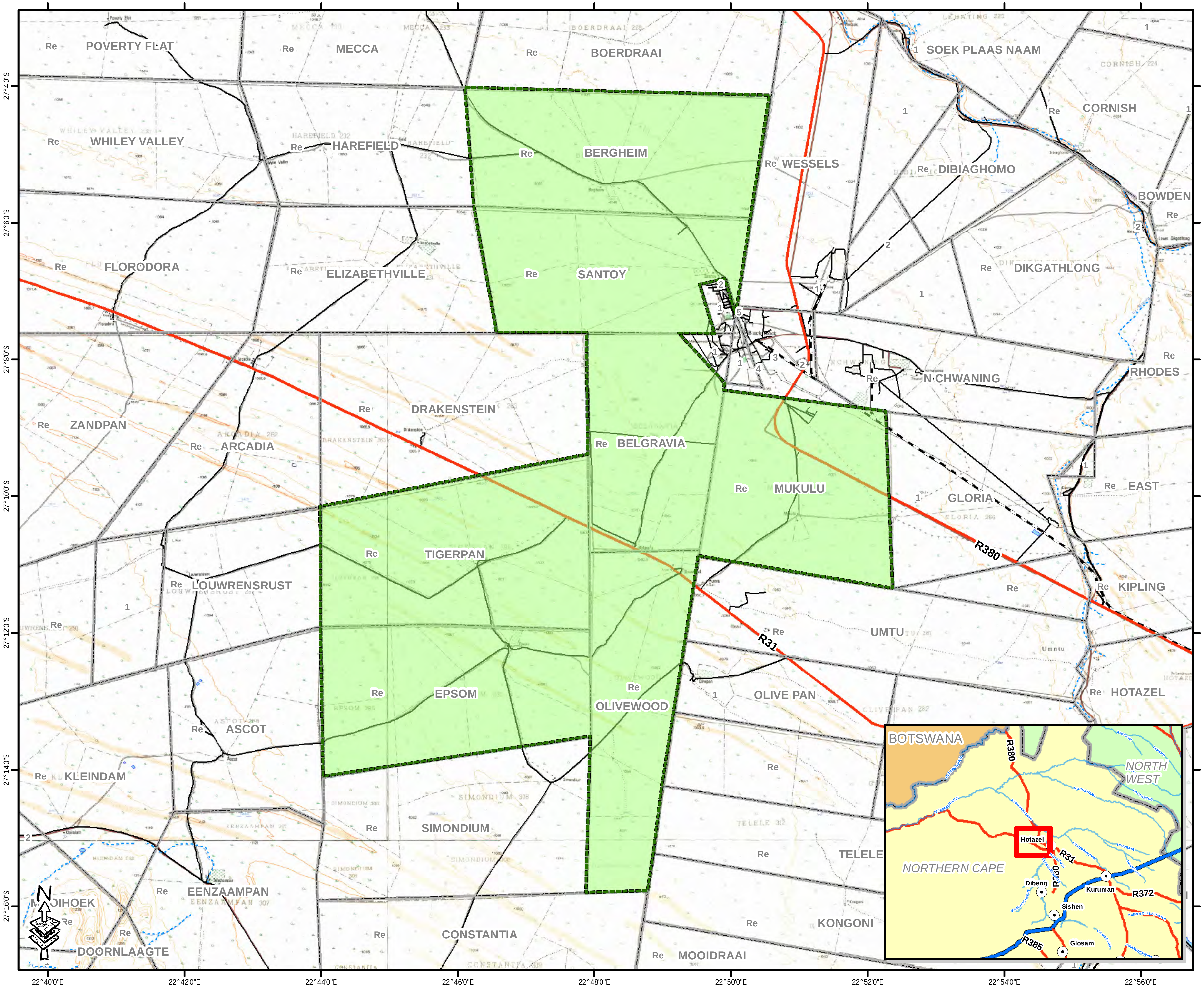
*: According to the title deeds (www.deeds.gov.za), the extent of Mukulu is “2373M509 VKRD Unknown”
1: M = Morgen. 1 hectare= 0.8567 M



[Figure not to scale- refer to A3 Map]

Figure 1.2 Mukulu Mine Locality

MUKULU PROJECT MINING RIGHT AREA



LEGEND

Railway Line

Road Network

National Route
Main Road
Secondary Road
Street

Rivers and Streams

Non-Perennial
Perennial

Dams

Project Area

Farm Portions

Data Sources: The Chief Directorate of Survey & Mapping
1:50 000 Topographical Series: 2722 BA, BB, BC & BD

FIGURE NO.:	-
MAP NUMBER:	12-105-20120411-01
DRAWN BY:	P. SNYDERS GIS TECHNICIAN
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	11 APRIL 2012
CLIENT:	EZENDALO LEGAL SOLUTIONS CC
PROJECT:	MUKULU 265 EMP
SCALE:	1:100,000

0 1 2 4 Kilometers

GCS

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PO Box 2597 Rivonia 2128
South Africa
Tel: +27 (0) 11 803 5726
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E-mail: jhb@gcs-sa.biz

1.5 Environmental Processes

The environmental processes are being undertaken with the aim to ensure that the proposed development complies with the relevant legislation (refer to Section 1.5.1). The following authorizations are being applied for:

- Mining Right in terms of Section 23 of the MPRDA. This is discussed further under Section 1.5.2 of this report;
- Environmental Authorisation for various activities listed in terms of Section 24 (2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). This application is discussed further under Section 1.5.3 of this report; and
- Integrated Water Use License (IWUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). This application is discussed further under Section 1.5.4 of this report.

1.5.1 Environmental Legislation

The Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) preparation process must take cognizance of various sets of legislation in order to be comprehensive and thorough. The following legislation is applicable to the proposed underground mine and as such the proposed development will need to comply with the provisions, of inter alia the following:

- The Constitution of South Africa, 1996 (Act No. 108 of 1996);
- The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 for 1998) (NWA); and

Other legislation which has been reviewed during the compilation of this document include:

- Hazardous Substance Act, 1973 (Act No.15 of 1973)(HSA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA);
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA);
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);

- The Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA); and
- The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHSA).

1.5.2 MPRDA process

A Mining Right Application was submitted to the DMR in November 2011 by Main Street for the properties covered by the prospecting right [(NC) 30/5/1/1/2/10041PR] granted in terms of Section 22 of the MPRDA.

Main Street was the holder of the prospecting right, which expired on 11 December 2012, by virtue of a notarial deed of cession executed on behalf of Interplay Trading 89 (Pty) Ltd and Ditswammung Mineral Resources Consortium (Pty) Ltd and Main Street on 3 October 2011.

A scoping report, as required in terms of regulation 49 of the MPRDA Regulations, Government Notice R527, dated 23 April 2004, was compiled and submitted to the DMR on 27 January 2012.

This document has been compiled in compliance with regulation 50 and 51 of the MPRDA Regulations.

1.5.3 NEMA Process

This section fulfills the requirement as per heading number 2.5 under Regulation 50 (a) (2) of the EMP template:
"Listed activities (in terms of the NEMA EIA regulations) which will be occurring within the proposed project"

Section 24 of the NEMA makes provision for the identification of activities which may not commence without authorization granted in writing by the competent authority.

These activities were promulgated under Government Notice Regulations (GNR) 544, and 545 in Government Gazette No. 33306 on 18 June 2010 (R544 and R545 repealed R386 and R387, respectively which were published on 21 April 2006).

An application for activities listed in terms of the GNR 544 and 545 was submitted to the Northern Cape Department of Environment and Nature Conservation (NCDENC), which is the competent authority for the application, on 4 May 2012. A reference number [NC/EIA/JTG/MOSH/HOT/2012] was issued by the NCDENC on 7 May 2012.

A public participation and EIA process which is required by the NEMA regulations, GNR 543, dated 18 June 2010, was initiated following the submission of the reference number. The applicable listed activities are provided in Table 1.3.

Table 1.3 NEMA listed activities triggered by the proposed development

RELEVANT NOTICE NO. AND DATE	ACTIVITY NO.	LIST ACTIVITY DESCRIPTION	TRIGGERED BY
ACTIVITIES WHICH REQUIRE BASIC ASSESSMENT			
GNR 544 of 18 June 2012	9	The construction of facilities or infrastructure exceeding 1000m in length for the bulk transport of water, sewage or storm water - i) with an internal diameter of 0,36 metres or more; or ii) with a peak throughput of 120 litres per second or more, excluding where: (a) such facilities or infrastructure are for bulk transport of water, sewage or storm water or storm water drainage inside a road reserve; or (b) where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.	A water pipeline is proposed to obtain potable water supply for the mine from the Vaal Gamagara Water Scheme which is managed by Sedibeng Water. Negotiations will be undertaken with Sedibeng water to secure water supply.
GNR 544 of 18 June 2012	12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010;	Water storage will take place on site. The exact volume of water to be stored will be confirmed following the Scoping Phase of the Project.
GNR 544 of 18 June 2012	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.	It is assumed that there will be some storage of dangerous goods, e.g. diesel storage and explosives.
GNR 544 of 18 June 2012	22	The construction of a road, outside urban areas - i. With a reserve wider then 13,5 meters or, ii. Where no reserve exists where the road is wider than 8 metres, or iii. For which an environmental authorization was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.	Haul roads will be constructed within the mine boundary. The width and lengths of these roads will be confirmed once the mine design is finalised.

RELEVANT NOTICE NO. AND DATE	ACTIVITY NO.	LIST ACTIVITY DESCRIPTION	TRIGGERED BY
GNR 544 of 18 June 2012	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - i. where the existing reserve is wider than 13,5 meters; or ii. where no reserve exists, where the existing road is wider than 8 metres, excluding widening or lengthening occurring inside urban areas.	Existing roads will be lengthened to provide access to the mine. The width and length of the access road will be confirmed once the mine design is finalised.
GNR 544 of 18 June 2012	53	The expansion of railway lines, stations or shunting yards where there will be an increased development footprint - excluding: i. railway lines, shunting yards and railway stations in industrial complexes or zones; ii. underground railway lines in mines; and iii. additional railway lines within the reserve of an existing railway line.	A privately owned railway line, which crosses the eastern corner of the MRA, is being investigated for the transport of ore to Hotazel, where the national Transnet network starts. A short spur and a loading station will be built, which will require 3.8km of railway track construction.
ACTIVITIES WHICH REQUIRE AN EIA			
GNR 545 of 18 June 2012	15	Physical alteration of undeveloped vacant or derelict land for residential retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more, except where such physical alteration takes place for: (i) Linear development activities; or (ii) Agriculture or afforrestation where activity 16 in this Schedule will apply.	The project will comprise the development of mining related surface infrastructure.
GNR 545 of 18 June 2012	20	Any activity which requires a mining right or renewal thereof as contemplated in Section 22 and 24 respectively of the Mineral and Petroleum Resources Development Act, 200 (Act 28 of 20902). [Date of commencement of Activity 20: to be proclaimed]	Opencast and Underground mining activities will be undertaken.

1.5.4 Integrated Water Use Licence Application

Section 21 of the NWA identifies 11 consumptive and non-consumptive water uses which must be authorized by the Department of Water Affairs (DWA), in terms of Section 40 of the NWA:

- 21 (a): Taking water from a water resource;
- 21 (b): Storing water;
- 21 (c): Impeding or diverting the flow of water in a watercourse;
- 21 (d): Engaging in stream flow reduction activity contemplated in Section 36;

- 21 (e): Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1);
- 21 (f): Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource;
- 21 (h): Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- 21 (i): Altering the beds, banks, course or characteristics of a watercourse;
- 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; and
- 21 (k): Using water for recreational purposes.

If the water uses listed above are not existing lawful water uses in terms of Section 32 of the NWA (water uses which took place during the two year period prior to the promulgation of the NWA) and is not a permissible water use in terms of Schedule 1 of the NWA (e.g. abstraction of groundwater for domestic use), it must be authorized by the following means:

- ***General Authorisation***: Section 21 water uses may be authorised by mean of a General Authorisation provided that the water use is within the limits and conditions set out in the General Authorisation. General Authorisations apply only to new water uses that took place after 1 October 1999 when the Act was fully promulgated;
- ***Water Use License (WUL):*** Water uses which exceed the limits set out under the applicable General Authorisation notices, require a water use license before they may commence. A Water Use License Application must be compiled in order to apply for a WUL from the Minister.

Once the necessary water uses and required volumes are finalized an Integrated Water Use License Application (IWULA) will be compiled and submitted to the DWA to apply for the authorization of the water uses applicable to the proposed development. It is assumed, based on the proposed size of the development, that a WUL will be required for the following water uses:

- 21 (b): Storing water;

- 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource; and
- 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; and

An Integrated Waste and Water Management Plan (IWWMP) will also be compiled and submitted as a supporting technical document to the IWULA. An IWWMP serves as a management tool for the mine to manage storm water, wastewater, etc.

1.5.5 Environmental Process Objectives

The relevant NEMA and MPRDA regulations were applied to the EIA/EMP processes to ensure that the processes were transparent to the public stakeholders and I&APs and to ensure that the processes were thorough. The environmental process has therefore aimed to:

- Facilitate the participation of any parties who may be directly or indirectly affected by the proposed project;
- Identify any potential fatal flaws which may detrimentally impact the proposed development;
- Identify all potential environmental, socio-economic and cultural/historical impacts;
- Develop management and mitigation measures (included in this EMP) in line with best practices to manage or avoid potential negative impacts; as well as measures to enhance potential positive impacts;
- Compiling an EIA Report that will be a truthful representation of foreseen impacts; and
- Compile an EMP that will assist in mitigating, managing and monitoring impacts.

In addition to the objectives set out above, the IWULA process will aim to:

- Proposed management/mitigation measures which will assist the proposed mine to comply with the relevant DWA Best Practice Guidelines;
- Ensure that the resource protection and waste management hierarchy is applied to the proposed mine; and
- Ensure that the proposed water uses take cognizance of other water users.

1.5.6 Environmental Assessment Practitioner

The environmental process and the necessary public consultation are being undertaken jointly by Ezendalo Legal Solutions cc (Ezendalo) and GCS (Pty) Ltd (GCS) (collectively the Consultants).

The Consultants provide a consists of highly trained staff that has a wealth of knowledge with respect to environmental legislation, as well as extensive experience in the fields of hydrogeology, hydrology and environmental science as well as environmental law.

The Consultants are independent and have no vested interest in the outcome of the environmental authorization applications.

The details of the Environmental Assessment Practitioners (EAPs) involved in the project are provided in Table 1.4.

Table 1.4 EAPs undertaking Mukulu Mine Environmental Processes

NAME	QUALIFICATION	YEARS OF EXPERIENCE IN ENVIRONMENTAL PROCESSES	ROLE IN THE ENVIRONMENTAL PROCESS
Janine Nolting	MBA, LLB, BSc Zoology	10	Technical and quality control
Tanja Bekker	MSc. Environmental Management (Pri. Sci. Nat)	9	Technical and quality control
Renee Francis-Steele	Bsc. Zoology	4	Document compilation
Estie Retief	M.A. Environmental Management	6	Facilitation of landowner consultation meeting
Jessica de Beer	BSocsci (Hons) Industrial Sociology and Labour Studies	8	Facilitation of landowner consultation meeting and review of public documentation.

1.6 Other Requirements

1.6.1 Land Use Rezoning

During April 2012, the South African Constitutional Court ruled that any land for which mining is planned must first be rezoned in accordance with the relevant municipal and provincial land use planning ordinances.

Main Street commits to obtaining any all necessary rezoning classifications prior to the commencement of the construction phase of the proposed mine.

1.6.2 Waste Management License

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA) came into effect on 1 July 2009 and repealed Section 20 (1) of the Environmental Conservation Act, 1989 (Act No. 73 of 1989) (ECA), which governed waste management activities

Section 20 of NEM: WA provides that no person may commence, undertake or conduct a waste management activity except in accordance with the requirements or standards determined in terms of Section 19 (3) for the activity.

The waste management activities were listed in Government Notice 718, in Government Gazette No. 32368, dated 3 July 2009. In terms of GNR718, a Basic Assessment process in terms of Section 24 (5) of NEMA must be undertaken to seek authorization for activities under Category A, while an Environmental Impact Assessment (EIA) process must be undertaken for all activities listed under Category B.

A sewage package plant will be required for the proposed mine. Based on an estimated required workforce of 700 people and an estimated volume of between 120l and 140l of sewage (grey and black water) per day, the estimated annual throughput requirements of the sewage package plant, once the mine reaches full production is between 30 660m^3 and 35 770m^3 per annum.

Such a sewage package plant will require a waste management license (WML). A full scoping and EIA process must be undertaken separate to the NEMA application and the results thereof submitted to the Department of Environmental Affairs before a WML can be issued.

Main Street commits to appointing an independent environmental assessment practitioner to apply for a WML once the details of the sewage package plant have been finalized.

1.7 Report Structure

This report has been compiled in compliance with the requirements of regulation 50 and 51 of the MPRDA Regulations, Government Notice R527, dated 23 April 2004

Chapter 1:

- This chapter provides a background to the project and the applicant; a description of the surface rights with regards to the MRA; a list of the applicable legislation reviewed during the compilation of this report, as well as a description of all the applicable environmental authorization application processes being undertaken with respect to the proposed mine.

Chapter 2:

- This chapter of the report provides a description of the baseline biophysical and socio-economic conditions of the project area. The information in this chapter has been obtained from the specialist studies undertaken as well as various desktop sources.

Chapter 3:

- This chapter provides a description of the proposed underground mine layout, mining method, required services, access routes, transport routes and surface infrastructure.

Chapter 4:

- This chapter provides a description of the project alternatives considered and a motivation for why the preferred alternative was selected.

Chapter 5:

- This chapter describes the stakeholder consultation process undertaken as well as the issues which were identified during the process. Further public consultation which is required as part of the NEMA and NWA applications is also described. The proof of public consultation is attached under Appendix C of this report.

Chapter 6:

- This chapter outlines the environmental management objectives and goals for the proposed mine.

Chapter 7:

- This chapter contains the following:
  - The construction, operational and decommissioning activities will impact on the biophysical and socio-economic environment;
  - A description of the environmental impact assessment methodology, impact assessment criteria and rankings;
  - The rating of the significance of the impacts posed by the proposed activities;
  - The management and mitigation measures, action plans, timeframes and costs with respect to avoiding and managing environmental and socio-economic impacts, as well as the associated costs.

Chapter 8:

- This chapter outlines the monitoring and auditing programmes which have been recommended by the relevant specialists. It includes objectives of each proposed monitoring programme, the location of monitoring points, the procedures to be followed when undertaking monitoring; the frequency of monitoring required; criteria to assess environmental performance, as well as the recommendations for internal and external (independent) auditing to be undertaken.

Chapter 9:

- This chapter sets out procedures to be followed during and after various types of incidents and accidents. It also sets out the procedure for inducting employees and informing all mine employees and contractors of the various risks which may results from the various activities on site and all required management and mitigation measures which are in place and that must be complied with in order to avoid environmental pollution and degradation. The environmental awareness and emergency response plan is attached under Appendix D of this report.

Chapter 10:

- The chapter provides the financial provision required for the project. The contents of this chapter are attached under Appendix E of this report.

Chapter 11:

- This chapter outlines the environmental rehabilitation to be undertaken following environmental disturbances caused by the proposed activities associated with the proposed mine.

Chapter 12:

- This chapter outlines the assumptions made during the specialist studies and environmental impact assessment, the adequacy of underlying assumptions, the uncertainties in the information provided, as well as recommendations to improve the accuracy of the information used to compile this report and the relevant appendices.

Chapter 13:

- This chapter is the conclusion to the report which summarises the results of the studies and contains the recommendations of the EAP.

Chapter 14:

- List of specialist reports which are appended to this document.

Chapter 15:

- This chapter is the undertaking that the EMP will be executed as approved and that the provisions of the Act and regulations thereto will be complied with.

Chapter 16:

- List of references used to compile this report.

2 ENVIRONMENTAL DESCRIPTION

The chapter describes the existing status of the receiving environment which will be impact on by the proposed mining activities and associated infrastructure development. As required by the EIA and EMP Template, the following information is included under this chapter:

REGULATION 50 (a):

- *(Section 1): Description of the baseline environment:*
  - *(Section 1.1): Concise description of the environment on site relative to the environment in the surrounding area;*
  - *(Section 1.2): Concise description of each of the existing environmental aspects both on the site applied for and in the surrounding area which may require protection or remediation;*
  - *(Section 1.3): Concise description of the specific land uses, cultural and heritage aspects and infrastructure on the site and neighbouring properties/farms in respect of which the potential exists for the socio-economic conditions of other parties to be affected by the proposed mining operation;*
  - *(Section 1.4): Annotated map showing the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms; and*
  - *(Section 1.5): Confirmation that supporting documents in the form of specialist studies are attached as appendices.*

REGULATION 50 (d):

- *(Section 1 – 8): Identification of the alternative land uses which will be impacted upon. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)*
- *(Section 1 – 9): Listed results of a specialist comparative land use assessment. (Refer to the concomitant section of the guideline posted on the official website of the Department and attach the specialist study as an appendix).*

Information has been obtained from the detailed environmental baseline studies which were undertaken in April/May of 2012 within the Mukulu Mine MRA as well as desktop research. The specialist reports are attached under Appendix B of this report.

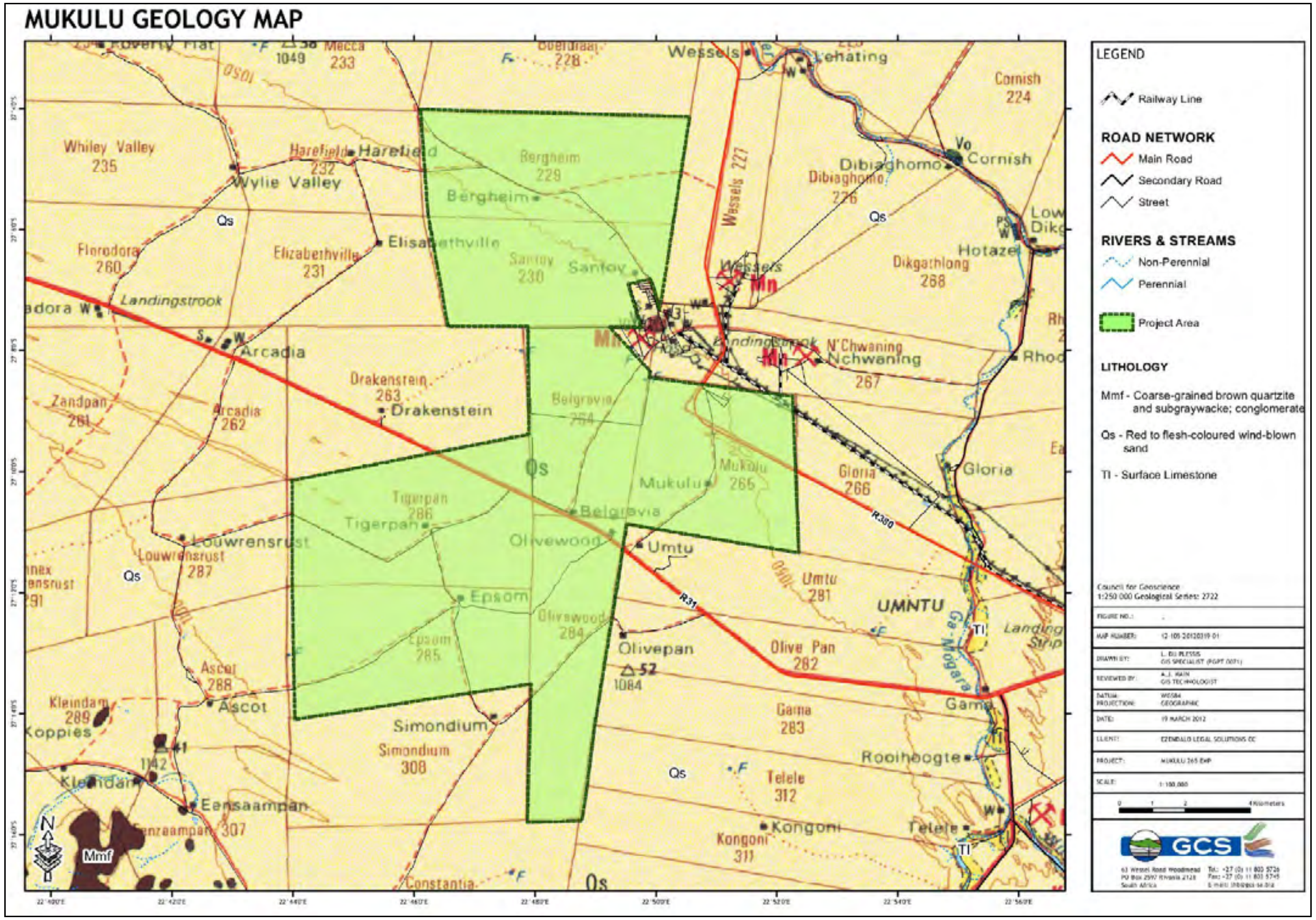
2.1 Geology

The regional geology of the project area is shown in Figure 2.1. The Kalahari Manganese Basin is situated within the Kuruman district of the Northern Cape Province and lies at approximately 1000 metres above sea level (masl). The MRA is located in the northern portion of the Kalahari Manganese Field (KMF). The KMF is an erosional basin spanning approximately 40km in the North-South dimension and 15 km in the East-West dimension. The regional strike in the study area is 330 degrees with a westward dip of around 7 degrees. The entire area is overlain by sediments of the Kalahari Formation and a surface geological map of the KMF is thus not available.

The lithologies in the project area belong to the Griqualand West sequence of the Transvaal Supergroup. The base of the study area is formed by the Ongeluk Lava consisting of an amygdaloidal andesite. The Hotazel formation overlies the lava and consists of a 40 – 100m thick banded iron formation (BIF). Three Manganese seams are intercalated in the BIF. The lowermost of these seams (LMO) is followed by the Manganese Marker seam (MMO) about 2 to 4 m above it. The upper Manganese seam (UMO) normally occurs about 20 m above the No 1 seam. The LMO has been extensively exploited in the past. The Hotazel formation is overlain by a sequence of Shales and Quartzites of the Mapedi Formation. Glacial sediments of the Dwyka Formation were found in the area and is thought to occupy NE – SW trending glacial valleys (Mukulu Mine Works Programme, undated). The Mapedi Formation is followed by the recent Kalahari Formation consisting of a series of aeolian sands, clays and gravels. The generalized stratigraphic column through the KMF is presented in Figure 2.2.

The main ore body is estimated to be between 430 and 800m deep (average 570m). There is also the potential for the ferruginous thrust Nappe ore bodies on the western half of the project area.

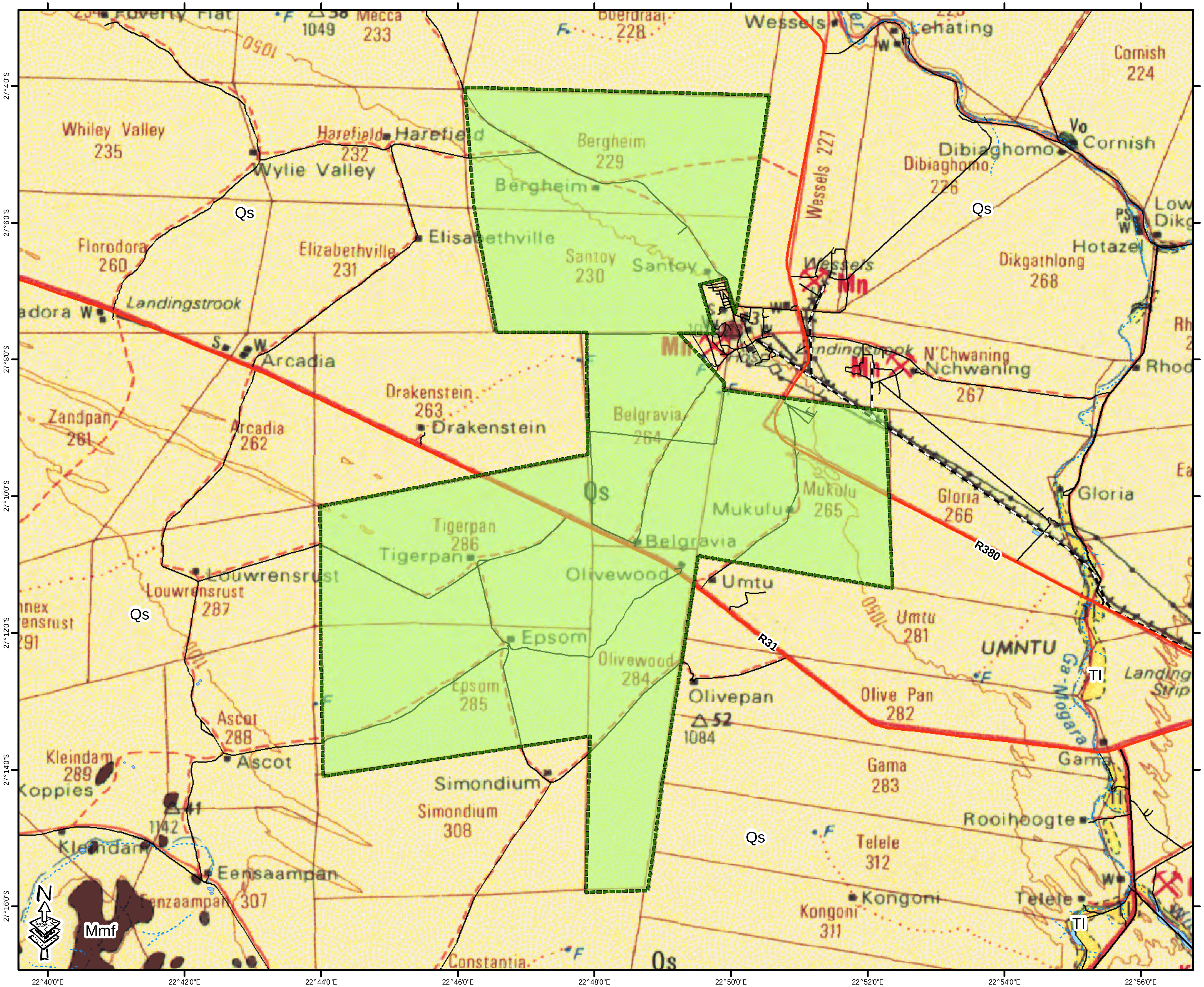
A total of nine (9) diamond exploration drill holes were completed during August 2010 and July 2011, of which the geological logs were available for evaluation. The Kalahari Formation can be divided into the upper sequence consisting of red Kalahari sands, calcareous sand, white calcrete, pebble bed in calcrete and calcareous clay overlying the lower thick red clay layer. The thickness for the upper sand calcrete layers range from ~40m to ~80m. The underlying red clay layer is absent in places and reaches a thickness of 48m south of the proposed slimes dam.



[Figure is not to scale- refer to A3 figure attached]

Figure 2.1 Geological Map of the Mukulu Mine MRA

MUKULU PROJECT - GEOLOGY MAP



LEGEND

Railway Line

ROAD NETWORK

Main Road

Secondary Road

Street

RIVERS & STREAMS

Non-Perennial

Perennial

Project Area

LITHOLOGY

Mmf - Coarse-grained brown quartzite and subgraywacke; conglomerate

Qs - Red to flesh-coloured wind-blown sand

TI - Surface Limestone

Council for Geoscience
1:250 000 Geological Series: 2722

FIGURE NO.:	-
MAP NUMBER:	12-105-20120612-01
DRAWN BY:	L. DU PLESSIS GIS SPECIALIST (PGPT 0071)
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	12 JUNE 2012
CLIENT:	EZENDALO LEGAL SOLUTIONS CC
PROJECT:	MUKULU 265 EMP
SCALE:	1:100,000

0 1 2 4 Kilometers

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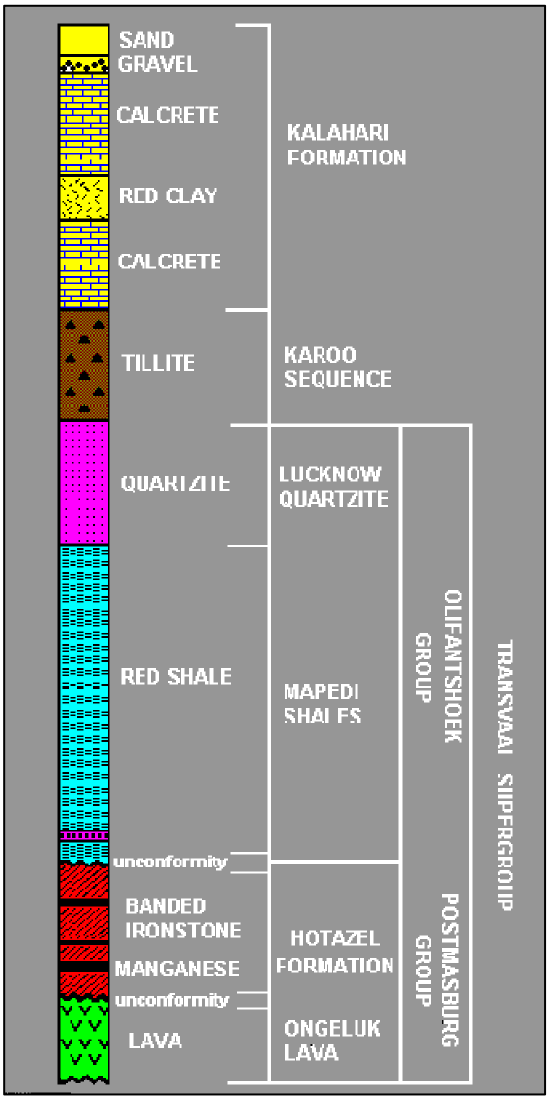


Figure 2.2 Generalised stratigraphic column of the Northern Portion of the KMF

2.2 Topography

The information in this section was obtained from the various specialist reports attached hereto under Appendix B.

The topography of the entire study area is generally flat and the general slope is in a north-easterly direction.

The proposed mining areas/resource blocks in the Mukulu Mine MRA are separated by a generally homogenous topography, which is mostly in the form of flat plains, with red sand dunes found throughout the area.

2.3 Climate

Information contained in this section is taken from the Hydrology report (GCS, refer to Appendix B-2) and the Soils report (TerrAfrica Consult, refer to Appendix B-5).

2.3.1 Regional Climate

The Northern Cape region is semi-arid and receives an annual rainfall of between 250 to 500 millimeters, with the majority of rain falling in the summer months between October and March. On average the best rains fall in mid to late summer, with February and March being the wettest months. Thunder storms are a common feature of the summer climate and hail may accompany summer storms (data obtained from the S.A. Weather Bureau for the Kuruman station).

The Mukulu Mine area is situated high in the north-eastern part of the Northern Cape Province in the vicinity of the Kalahari Desert. The region is considered water scarce with low annual rainfall, most of which is received during summer.

More detailed information regarding the climatic conditions of the project area is provided for the Mukulu Mine area below according to Kathu weather station data, located at longitude 23.65° and latitude -28.00°, and altitude of 1127m. It should however be noted that Kathu is located approximately 60km from the proposed project site.

2.3.2 Temperature

According to the Kathu weather station data, mean monthly maximum temperatures range between 18°C and 32°C and can on some days be as high as 43°C while mean monthly minimum temperatures can be anything between 1°C and 17°C (Refer to Figure 2.3) and there is an average ground frost frequency of 7% during winter months.

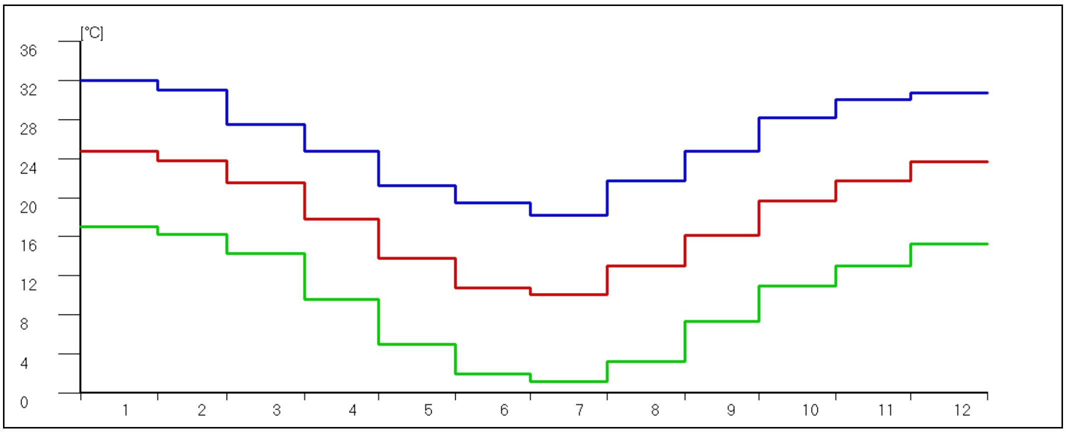


Figure 2.3 Average daily maximum temperature (blue), average daily mean temperature (red) and average daily minimum temperature (green) in ˚C

In the summer there is an average of 9.8 to 10.1 sunshine hours per day and average day lengths of 12 to 14 hours. The sunshine fraction is the percentage of time when bright sunshine is recorded during the day. It is directly linked to cloudiness, with full cloud cover being equal 0% of sunshine fraction. The highest sunshine fraction for the study area was measured in the month of August at 82%.

2.3.3 Rainfall

The Mukulu Mine area is situated high in the north-eastern part of the Northern Cape Province in the vicinity of the Kalahari Desert. The region is considered water scarce with annual rainfall ranging between 300mm and 400mm, most of which is received during summer months (Refer to Figure 2.4).

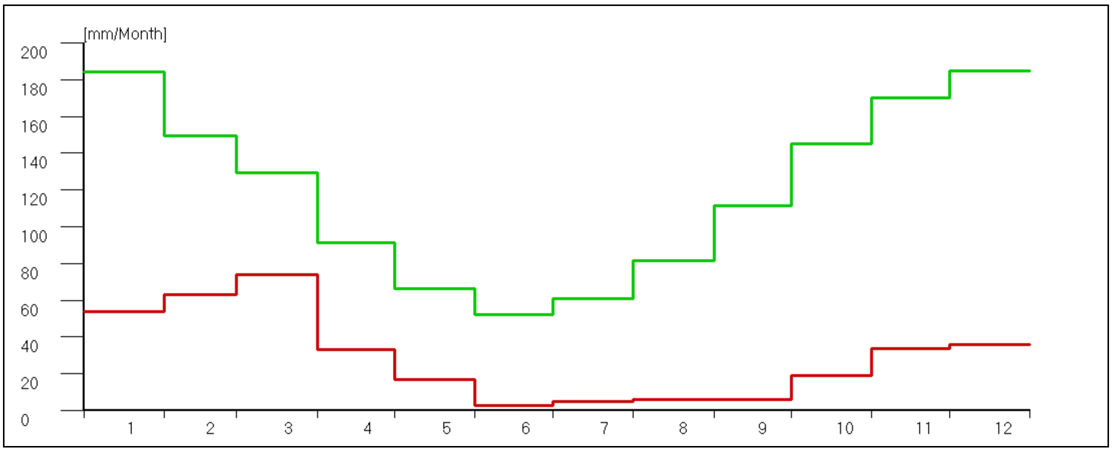


Figure 2.4 Annual rainfall (red) and Potential Evapo-transpiration (PET) (green) in mm/Month from month 1 (January) to month 12 (December)

Rainfall records for the region as a whole seem to vary considerably. Hotazel reported 270 mm per annum, whilst a local game ranch and rainfall maps indicate 375 mm per annum. This suggests that rainfall for the site varies between 280 and 380 mm per annum. It is assumed that the entire site will experience Mean Annual Precipitation of 300 mm, which will be distributed as shown in Figure 2.5.

Rainfall that will be exceeded in 50% of years (for any chosen month) is represented by the E50 line.

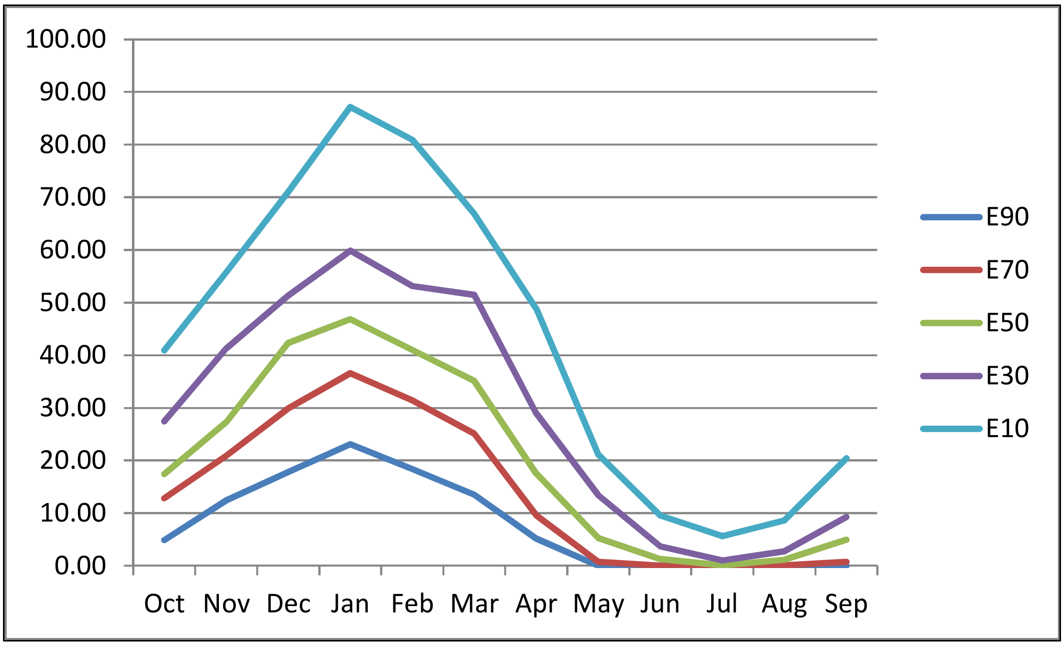


Figure 2.5 Rainfall Probability Distribution of Hotazel

2.3.4 Evaporation

The various sources of climate data agree that local A-Pan evaporation will be in the order of 2400 mm per annum, but some further investigation is required in order to describe the distribution of this evaporation per month. The mean annual evaporation exceeds mean annual rainfall.

2.3.5 Local Wind Field

According to the Kathu weather station data, winds in the area have been recorded to blow at a maximum speed of up to 6.48 km/h (Refer to Figure 2.6). The highest vapour pressure recorded in this area is 15.10 hPa and this occurs during the months of February and March.

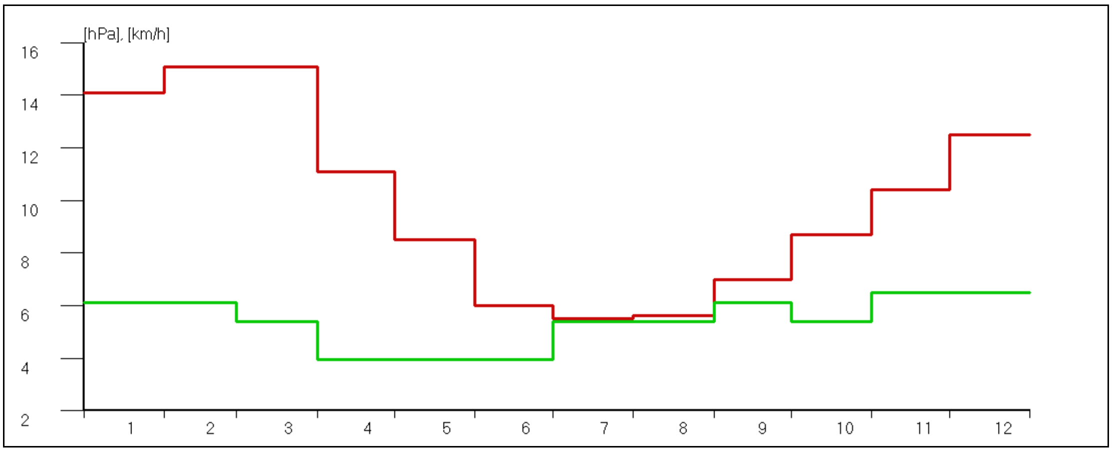


Figure 2.6 Average water vapour pressure (red) in hPa and average wind speed (green) in km/h from month 1 (January) to month 12 (December)

2.3.6 Extreme Weather Conditions

Extreme weather conditions which occur within the project area include thunderstorms during the rainy summer months, which may be accompanied by lightning, heavy rain, strong winds and sometimes hail. The area also occasionally experiences of frost during winter months.

2.4 Land use and Land Capability

Information contained in this section is taken from the Soils report (TerraAfrica Consult, attached herewith as Appendix B-5).

2.4.1 Land Type

Three (3) land types, i.e. Ah5, Af28 and Ae6, were identified in the study area according to the spatial data obtained from the database of the Agricultural Research Council's Institute for Soil, Climate and Water (Refer to Figure 2.7 and Table 2.1).

Table 2.1 Land Type Data for the Mukulu Mine Site

LAND TYPE	AREA (ha)	GEOLOGY
Ah5	7 507	Aeolian sand of Tertiary Kalahari Beds
Af28	2 586	Wind-blown sand of Tertiary to Recent Age
Ae6	4 593	Wind-blown sand of Tertiary to Recent Age, with brown quartzite outcrops

2.4.1.1 Land Type - Ah5

Land Type Ah5 consist of freely drained, red and yellow-brown apedal soils that are freely drained with no restrictive clay layers in the sub-surface horizons but may consist of shallow profiles due to the presence of restrictive rock layers.

This land type is found in the northern half of the project area and consists of aeolian sand of recent age with occasional outcrops of Tertiary Kalahari beds. The landscape is very flat and slopes are never steeper than 3%. Landscape Position 5 indicates areas where pans of water accumulate during rainy periods as a result of exposed calcrete layers that are very slowly permeable to water. Clay percentages range between 2% and 10%.

2.4.1.2 Land Type - Af28

This land type is found in elevations higher than a 1000m and consist of four different landscape positions where Positions 1 and 3 are associated with areas with top and slope of Kalahari Sand dunes and Positions 4 and 5 with the bottom of these sand hills. Position 5 indicates areas where wind and water movement have removed the sandy layer and the calcrete subsurface horizon is exposed. These exposed areas (calcrete pans) often lead to the accumulation of water for short periods during the rainy season. Slopes for this land type range between 0 and 30%.

2.4.1.3 Land Type - Ae6

The characteristics of this land type are very similar to that of land type Af28, although sand dunes do not occur and the slope of the landscape is more even. Rocky outcrops occur here and there in this land type. Clay content of soils in this land type is never higher than 15%.

2.4.2 Land use

Land in the project area is mainly used for extensive for cattle, sheep, goat and game farming. The game farming areas also have the potential to be developed into tourism destinations.

The Assmang Manganese Black Rock Mine is situated east of the project area.

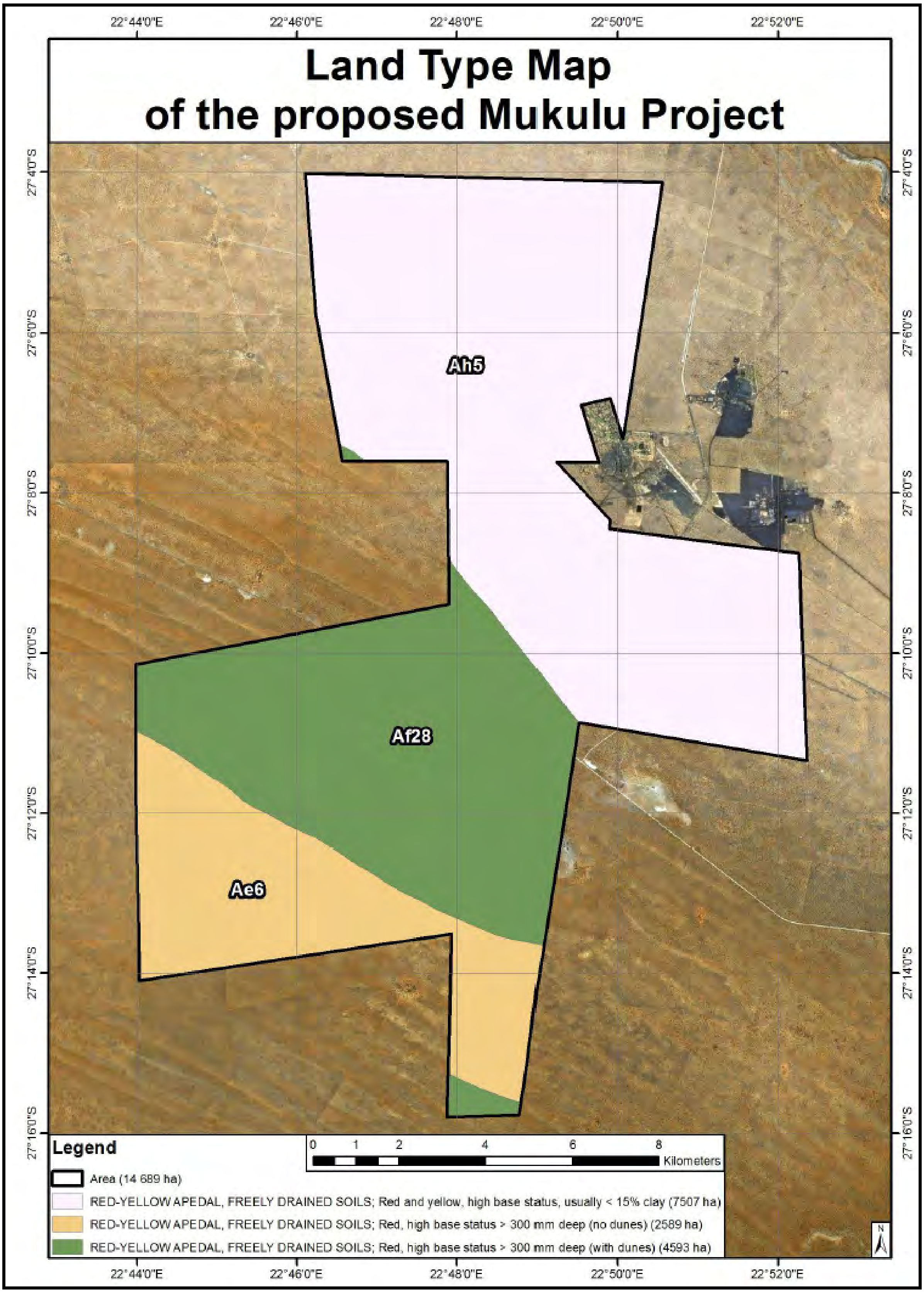


Figure 2.7 Land type Map for the Mukulu Mine MRA

2.4.3 Land Capability

Although some areas with deep soil profiles may be suitable for crop production from a soil capability perspective, there are also climatic restrictions to agricultural potential. The high evaporation, due largely to high temperatures, exceed the low rainfall in the region.

Even the best soils are unsuited for dryland agriculture under these conditions. Therefore, the entire area has grazing land capability and the grazing capacity for the area is 14 hectare per large stock unit.

2.5 Soils

Information contained in this section is taken from the Soils report (TerraAfrica Consult, attached herewith as Appendix B-5).

Six (6) different soil forms are present in the entire study area as well as in the areas currently indicated as the proposed footprint (Refer to Figure 2.8). The soil forms identified include soils of the Hutton and Clovelly forms which are deeper than 1000mm and that correlate very well with the areas where Acacia erioloba grows and shallow soils that include a combination of Molopo and Coega forms where the topsoil or shallow B1-horizon is underlain by a hardpan carbonate horizon.

Areas where depressions or pans were identified are associated with the Coega and Plooysburg soil forms which are not hydromorphic (wetland) soil forms and can be used for development purposes. Apart from the six soil forms, there are also additional areas where human activities have disturbed soil to such an extent that the original soil profiles can’t be classified any longer. These areas are called anthropic soils.

The areas for these soil forms are summarised in Table 2.2

Figure 2.8 Soil Map of the Mukulu Mine MRA

Table 2.2 Summary of soil forms in the study area

SOIL FORM	MAP COLOUR	AREA (HA)	% OF STUDY AREA	SOIL GROUP
Molopo		1940	13.2	Calcic
Clovelly		3804	25.9	Oxidic
Askham		3189	21.7	Calcic
Plooysburg		998	6.8	Calcic
Hutton		3883	26.4	Oxidic
Coega		859	5.8	Calcic
Disturbed Soil Profiles		10	0.1	Anthropic
Other Mining Areas		5	0.0	Anthropic
Water Body		1	0.0	Calcic

2.5.1 Oxidic soils

Oxidic soils are the main soil group identified in the study area and comprise the largest surface area (52.3%). Soils that developed within this group either have a red apedal or yellow-brown apedal horizon underlying an orthic A-horizon. No red structured profiles were identified on this site. These oxidic soils are associated with the Kalahari Sand Dunes that have been stabilised by vegetation over hundreds of years.

The name of this soil groups has been derived from the oxides of iron that accumulate through weathering and colour many soils - uniformly if the conditions are well drained and aerated. The red colour of hematite signifies conditions that are warmer, drier, and less affected by organic matter than those indicated by the yellow-brown colour of goethite. Hematite is the stronger of the two clay pigments and many red soils contain more goethite than hematite.

The concept underlying the group is one of relative maturity coupled with free drainage and aeration.

2.5.1.1 Hutton soil form

The Hutton soil form comprises 26.4% of the project area. The Hutton soil form consists of an orthic A horizon on a red apedal B horizon overlying unspecified material. All Hutton profiles are deeper than 500mm and some are deeper than 1500mm with no restrictive layers and are structureless or have very weakly developed structure. Hutton soils with no restrictions shallower than 500mm are generally good for crop production. The red apedal B1-horizon has more or less uniform "red" soil colours in both the moist and dry states and has weak structure or is structureless in the moist state. This horizon develops in well-drained, oxidizing environments that produce coatings of iron oxides (hematite) on the soil particles, causing the red colours of the horizon.

The red apedal horizon is per definition non-calcareous within 1500mm of the soil surface, but may contain small lime nodules as was the case on site. The range of red colors that is a key identification tool in differentiating between a red apedal and yellow-brown apedal is defined by the Soil Classification Working Group Book, 1991. Some of the defining red soil colors identified on the sites are bleached (10R 6/4 and 10R6/6), while some are bright red (2.5YR 4/8). Textures are coarse to medium sand to sandy-loam in the topsoil and medium to fine sandy-loam in the subsoil. Structure is weak blocky (dominant) or apedal in all horizons.

2.5.1.2 Clovelly soil form

The Clovelly soil form comprises 25.9% of the project area. The texture of this oils form is fine sandy to sandy-loam to loam for all horizons and profiles were not shallower than 600mm and some were deeper than 1500mm. The high to moderate quality orthic A and yellow-brown apedal B-horizons are suitable materials for annual cropping (good rooting medium) should the climate permit and use as topsoil, having favourable structure (apedal) and consistence (friable).

The Clovelly form has an orthic A horizon overlying a yellow-brown apedal B1-horizon with unspecified material underneath the apedal horizon. The unspecified material does not have any signs of wetness. The orthic A-horizon is between 100mm and 300mm deep. The yellow-brown apedal horizon has more or less uniform "yellow-brown" soil colours in both the moist and dry states and has weakly developed blocky structure or is structureless in the moist state. This horizon develops in a well-drained oxidizing environment, but with different mineral-chemical coatings (goethite) on soil particles than those of the red apedal horizon.

2.5.2 Calcic soils

The carbonate-rich horizons that characterises these soils are a result of the continuing accumulation of, especially, calcium, but also magnesium carbonate over a long period. The formation conditions needed for the development of these calcic soils are strongly governed by an arid or semi-arid climate. Calcic soils are low in organic matter as a result of generally sparse vegetation cover and the rapid decomposition of organic material in the often hot and dry conditions. These same conditions, however, result in the soils being base-rich with little leaching of plant nutrients. The exchange complex is nearly always close to being 100% saturated with, unsurprisingly, calcium and magnesium the dominant cations. The pH of calcic soils is close to neutral in the topsoil and somewhat higher below, where carbonate is more common and the acidifying influence of the organic matter mitigated.

The calcic soils identified on site include soils of the Coega, Molopo, Plooysburg and Askham forms.

2.5.2.1 Coega soil form

The Coega soil form comprises 5.8% of the project area. The soil form consists of an orthic A horizon on a hardpan carbonate horizon. The orthic A horizon has bleached colour, sandy loam texture and is never deeper than 300mm.

The hardpan carbonate horizon is massive and extremely hard and act as a barrier to root growth. It is also only slowly permeable to water and these areas can form temporary pans after a rain storm. This soil form is not suitable to crop production due to the shallow soil depth.

2.5.2.2 Plooysburg form

The Plooysburg soil form comprises 6.8% of the project area. The Plooysburg soil form identified on site is associated with the pans and depressions in the landscape. This soil form consists of an orthic A horizon overlying a red apedal B1-horizon that is underlain by a hardpan carbonate horizon.

This hardpan carbonate horizon is massive, vesicular and extremely hard when dry and hard or very firm when moist. It is a result of continuing accumulation of calcium and/or calcium-magnesium carbonates over a long period of time that is often a barrier to plant roots and slowly permeable by water.

The orthic A horizon of these profiles are very shallow (0.05 – 0.15 m) as is the red apedal B1-horizon. All horizons overlying the hardpan carbonate horizon have sandy texture. The Plooysburg soil form is limited by climate, chemical properties and physical depth to soils suitable for extensive grazing purposes.

2.5.2.3 Askham form

The Askham soil form comprises 21.7% of the project area. The Askham soil form identified is similar to that of the Plooysburg form with the only difference that the orthic A horizon is underlain by a yellow-brown apedal B horizon that is overlying the hardpan carbonate horizon. The yellow-brown apedal horizon is structureless (apedal) and between 0.20 and 0.75 metre deep on site. This horizon is non-calcareous and has yellow-brown colour values as determined by the guidelines of the South African Soil Classification System. This soil form is also suitable for extensive grazing purposes by livestock and game species

2.5.2.4 Molopo form

The Molopo soil form comprises 13.2% of the project area. The Molopo soil form consist of an orthic A horizon that is underlain by a yellow-brown apedal B horizon that is overlying the soft carbonate horizon. The yellow-brown apedal horizon has the same characteristics as that described for the Askham and Clovelly soil forms and contains lime nodules in the yellow-brown apedal horizon. The soft carbonate horizon is much softer than the hardpan carbonate horizon and can easily be cut with a spade.

2.5.3 Anthropic soils

This group includes soils that have so profoundly affected by human disturbance that their natural genetic character has either largely been destroyed, or in many cases, has had insufficient time to be expressed into something else. On the project site this includes an area of 10 ha of old quarries and an area of 5 ha of existing mining activities.

2.5.4 Chemical Soil Properties

The pH (H_2O) of the analyzed soil samples range between 4.2 and 7.5. The soils found within the project area can be described as extremely acid to mildly alkaline. The higher pH levels of most of the samples are a function of the dry, shallow profiles that contain calcrete nodules or which are underlain by a hardpan carbonate horizon.

The phosphorus (P) levels measured range between 1 and 2 mg/kg. Although this seems very low for a crop production situation, it is normal for South African veld conditions. Calcium levels range between 19 to 557 mg/kg, magnesium between 6 and 235 mg/kg and potassium between 21 and 95 mg/kg. These levels are all ranging between deficient to sufficient for crop production. Sodium levels are sufficiently low.

The interpreted results indicated that the soil identified on site falls in four (4) different texture classes – loamy sand, sandy loam, medium loam and sand. All these samples have low clay content (<28%) and are dominated by the sand fraction. This results in the soil forms on site being susceptible to erosion, especially wind erosion.

2.6 Flora

2.6.1 Regional Context

This information under this section was obtained from the Terrestrial Biodiversity Report compiled by Bathusi Environmental Consulting (Refer to Appendix B-3).

Existing data of the general surrounds indicate that the area is positioned within the Savanna Biome (Mucina & Rutherford, 2006), comprising portions of the Kathu Bushveld and Gordonia Duneveld (Figure 2.9). Both these vegetation types are currently afforded a (national) 'Least Threatened' conservation status.

2.6.1.1 Gordonia Duneveld

According to the report (Appendix E-3), vegetation and landscape features in the Gordonia Duneveld are characteristically parallel dunes about 3-8 m above the plains. This unit also occurs as a number of loose dune cordons south of the Orange River near Keimoes and between Upington and Putsonderwater. It is typically an open shrubland with ridges of grassland dominated by Stipagrostis amabilis on the dune crests and Acacia haematoxylon on the dune slopes, also with a mellifera on lower slopes and Rhigozum trichotomum in the interdune streets are typical of this unit. The conservation status of this unit is regarded Least Threatened with only 14% statutorily conserved in the Kgalagadi Transfrontier Park. Very little of the area is transformed and erosion is very low.

Species that typifies this area include small tree (*Acacia mellifera* subsp. *Detinens); tall* shrubs (*Grewia flava* and *Rhigozum trichotomum)* low shrubs (*Aptosimum albomarginatum, Monechma incanum* and *Requienia sphaerosperma); succulent shrubs (Lycium bosciifolium, L. pumilum* and *Talinum caffrum); and* graminoids (*Schmidtia kalahariensis, Brachiaria glomerata, Bulbostylis hispidula, Centropodia glauca, Eragrostis lehmanniana, Stipagrostis ciliata, S. obtusa* and *S. uniplumis)*

Biogeographically, important taxa (Kalahari Endemics) include the tall shrub *Acacia haematoxylon*, the graminoids *Stipagrostis amabilis, Anthephora argentea, Megaloprotachne albescens* and the herbs *Helichrysum arenicola, Kohautia ramosissima* and *Neuradopsis austro-africana*.

2.6.1.2 Kathu Bushveld

This vegetation type is situated on the plains of Kathu and Dibeng in the south, through Hotazel, vicinity of Frylinkspan to the Botswana border roughly between Van Zylsrus and McCarthysrest. The vegetation comprehends a medium-tall tree layer with *Acacia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. The shrub layer is generally most important with, for example, *A. mellifera, Diospyros lycioides* and *Lycium hirsutum*. The grass layer is variable in cover and composition.

According to the report (Appendix E-3), species that typifies this unit include trees (*Acacia erioloba, A. mellifera subsp. detinens, Boscia albitrunca and Terminalia sericea*); tall Shrubs (*Grewia flava, Diospyros lycioides, Dichrostachys cinerea, Gymnosporia buxifolia and Rhigozum brevispinosum*); low shrubs (*Aptosimum decumbens, Grewia retinervis, Nolletia arenosa, Sida cordifolia and Tragia dioica*); Graminoids (*Aristida meridionalis, Brachiaria nigropedata, Centropodia glauca, Eragrostis lehmanniana, Schmidtia pappophoroides, Stipagrostis ciliata, Aristida congesta, Eragrostis biflora, E. Chloromelas, E. heteromera, E. pallens, Melinis repens, Schmidtia kalahariensis, Stipagrostis uniplumis and Tragus berteronianus*); and Herbs (*Acrotome inflata, Erlangea misera, Gisekia africana, Heliotropium ciliatum, Hermbstaedtia fleckii, H. odorata, Limeum fenestratum, L. viscosum, Lotononis platycarpa, Senna italic subsp. arachoides and Tribulus terrestris*).

Biogeographically, important species that are present in this unit include the small tree *Acacia luederitzii* var. *luederitzii;* the graminoid *Anthephora argentea, Megaloprotachne albescens, Panicum kalaharense;* and the herb *Neuradopsis bechuanensis*.

The regional diversity distribution records indicate the presence of only 78 plant species within the ¼- degree grids that are sympatric to the study area, reflecting a poor floristic knowledge of the region. Results of previous surveys within the region indicate that much higher species diversity is expected; also taking cognisance of the habitat variation that presents itself within the region. The savanna physiognomy is manifested in the dominant growth forms of the region, physiognomically dominated by trees and shrubs and grass dominated dunes.

Various nationally and provincially protected species are likely to occur including (but not limited to) the following listed in Table 2.3 within the area.

Table 2.3 Regional Plant species of conservation consideration

SPECIE NAME	STATUS
Acacia erioloba	Declining, Protected tree
Acacia haematoxylon	Protected tree
Babiana hypogaea	Declining
Boophone disticha	NA
Boscia albitrunca	Protected tree
Harpagophytum procumbens, H. zeyheri	NA
Family Amaryllidaceae (*Ammocharis coranica, Nerine laticoma*);	NA
Family Iridaceae	NA
Family Liliaceae (*Aloe* species)	NA
Olea europaea subsp. *africana*	(Protected tree).

Figure 2.9 Regional Vegetation Types

2.6.2 Botanical Diversity of the Site

A total of 88 plant species were recorded during the field investigations conducted in May 2012 by Bathusi Environmental Consulting. Due to seasonal limitations, various species could not be identified to an acceptable level of certainty and these species were therefore excluded from the list. It is strongly recommended that suitable surveys be conducted during the following austral summer period in order to augment the species list as well as identify potentially important species.

The recorded diversity could also not be compared to existing regional floristic information due to poor sampling records within the particular ¼-degree grid that is sympatric to the study sites. In spite of survey limitations, the diversity of plant species recorded on this site is regarded as moderately high. It is therefore reasonable to expect a higher diversity of plant species to be present during the austral summer period, particularly in perennial plant groups, such as geophytes and forbaceous species.

According to the report (Appendix B-3, a well-developed herbaceous stratum (Table 2.4) is represented by 34 forbs (38.6%) and 23 grass species (26.1%). A physiognomically dominant shrub and tree layer is represented by 19 shrub species (21.6%) and 5 tree species (5.7%). This floristic diversity is represented by 37 families, dominated by Poaceae (23 species, 26.1%), Fabaceae (11 species, 12.5%) and Asteraceae (9 species, 10.2%) (Refer to Table 2.5).

The physiognomy and diversity exhibited by natural habitat with the study areas is regarded representative of the regional vegetation types. Extremely little degradation and transformation is noted on a local and regional scale. It is therefore concluded that the vegetation is in a primary climax status.

Table 2.4 Growth Forms recorded in the site area

GROWTH FORM	NUMBER	PERCENTAGE
Climber	2	2.3%
Forb	34	38.6%
Geophyte	4	4.5%
Grass	23	26.1%
Parasite	1	1.1%
Shrub	19	21.6%
Tree	5	5.7%
Total	88	

Table 2.5 Plants families recorded in the site area

Growth Form	Number	Percentage
Acanthaceae	1	1.10%
Aizoaceae	1	1.10%
Amaranthaceae	1	1.10%
Amaryllidaceae	3	3.40%
Anacardiaceae	1	1.10%
Asclepiadaceae	1	1.10%
Asteraceae	9	10.20%
Bignoniaceae	1	1.10%
Boraginaceae	1	1.10%
Capparaceae	4	4.50%
Chenopodiaceae	2	2.30%
Combretaceae	1	1.10%
Commelinaceae	1	1.10%
Cucurbitaceae	1	1.10%
Cucurbiteae	1	1.10%
Ebenaceae	1	1.10%
Ehretiaceae	1	1.10%
Fabaceae	11	12.50%
Illebracaceae	1	1.10%
Lamiaceae	1	1.10%
Liliaceae	1	1.10%
Loranthaceae	1	1.10%
Malvaceae	2	2.30%
Meliaceae	1	1.10%
Mimosaceae	1	1.10%
Oleaceae	1	1.10%
Oxalidaceae	1	1.10%
Papaveraceae	1	1.10%
Pedaliaceae	1	1.10%
Poaceae	23	26.10%
Rhamnaceae	1	1.10%
Scrophulariaceae	1	1.10%
Selaginaceae	1	1.10%
Solanaceae	2	2.30%
Sterculiaceae	2	2.30%
Tiliaceae	2	2.30%
Zygophyllaceae	2	2.30%

At this stage, no 'threatened' species were recorded during the survey period in the study areas. This might however be a reflection of the constraints of a winter sampling period.

Since much of the remaining natural habitat within the study area comprises primary climax status woodland habitat, the possibility that Red Data species might be present within the study area cannot be excluded at this stage. Species like Acacia erioloba and Boophone disticha were recorded to be in a declining state in the site. This implies that the species is declining but the population has not yet reached a threshold of concern and limited loss of habitat may be permitted. If individuals will not be conserved in situ, plants should be rescued and used as mother stock for medicinal plant cultivation programmes.

It was further identified that within the area, there are some tree species that are protected in terms of the (National Forests Act (Act no 84 of 1998)) and these are listed in Table 2.6.

Table 2.6 Protected Tree Species of the Region within the proposed mining site

TAXON	FAMILY	ESTIMATE
Acacia erioloba	Fabaceae	More than 100
Acacia haematoxylon	Fabaceae	More than 100
Boscia albitrunca	Capparaceae	More than 100
Olea europaea subsp. *africana*	Oleaceae	Less than 20

In addition to the above, there are additional tree species that are provincially protected plants within the proposed mine area. These include *Ammocharis coranica* (Family Amaryllidaceae); *Boophone disticha* (Family Amaryllidaceae); and *Nerine laticoma* (Family Amaryllidaceae). The prence of *Babiana hypogaea; Harpagophytum procumbens; Harpagophytum zeyheri*; Family Amaryllidaceae; and *Family* Iridaceae is also likely within the proposed mining area.

2.6.3 Habitat Types of the Site

Natural (untransformed) vegetation of the study area and the surroundings is strongly representative of the regional vegetation types, exhibiting extremely limited (localised) divergence from the species composition, diversity and vegetation structure described by Mucina and Rutherford (Vegmap, 2006). Typical of the vegetation of the region is that extremely little zonality is observed in vegetation forms. Because only some parts of the area were investigated in detail, results were extrapolated to include the remainder of the study areas. ***This represents a significant information gap and suitable surveys should be conducted during the following austral summer period in order to augment results of this particular assessment***. In addition, because inadequate site-specific surveys were conducted, data could not be subjected to classification programmes (TWINSPAN, PCORD 6), and subsequent descriptions are based on visual observations.

Three micro habitat types and variations were identified during photo analysis and site investigation within the proposed project site. These were classified as degraded and transformed habitat, woodlands community, and pans/impoundments (Figure 2.10) as summarised below. The full description of each habitat types and variations are indicated under section 7.6 of the Terrestrial Biodiversity report (Appendix B-3).

2.6.3.1 Degraded and transformed habitat

These areas generally comprise parts of the landscape where anthropogenic effects caused an irreversible change in the vegetation. Clearance of land for building of roads, houses and the mining of resources resulted in severe changes to the habitat. These include degraded woodland which comprise of 40.1ha; excavations which comprise of 9.3ha; and roads, mining area and infrastructure which comprise of 20.4 ha of the Mukulu area.

According to the report (Appendix E-3), no aspect of sensitivity is expected to be present within these areas and a low status and sensitivity is ascribed to these land types and its transformation. However, the presence of protected trees was noted within the degraded woodland transformation.

2.6.3.2 Woodland community

Natural woodland of the three mining sites is representative of the natural variations that is encountered on a local and regional scale. The physiognomy is dominated by a well-developed tree/ shrub layer that tends to encroach where intense and high grazing pressure is applied. A species rich herbaceous layer is characteristic of the region, comprising a grass layer of which the composition provides an indication of the reaction of the herbaceous layer on grazing strategies. Imbedded within this savanna type, there are various local and regional variations that establish based on soil characteristics. Localised areas of a typical habitat occur where underlying geology is exposed.

Within the site, Calcareous Interdune Straaten, Dune Savanna, Natural Woodland (Closed Shrubveld), and Natural Woodland (Open Treeveld) are dominant woodland community transformations. A high floristic status and a medium-high floristic sensitivity are ascribed to these variations. Various protected trees were recorded within these units and a moderate probability is estimated for other species of conservation importance occurring within this community.

2.6.3.3 Pans / Impoundments

Localised areas of pans/ impoundments are present within the area. Due to limitations experienced during this investigation, no surveys were conducted within these parts. It is however likely that the vegetation will be dominated by the protected trees *Acacia erioloba* and the forb *Tribulus terrestris*, similar to vegetation patterns around watering points. A high floristic status and a medium-high floristic sensitivity are ascribed to these areas. The Floristic sensitivity estimations for the respective habitat types in the Mukulu area are shown in Figure 2.11.

Table 2.7 Floristic sensitivity estimations for the respective habitat types

CRITERIA	RED DATA SPECIES	LANDSCAPE SENSITIVITY	STATUS	SPECIES DIVERSITY	FUNCTIONALITY/ FRAGMENTATION	CRITERIA	RED DATA SPECIES	LANDSCAPE SENSITIVITY
COMMUNITY	CRITERIA RANKING							
Degraded Woodland	4	3	3	4	5	117	37%	medium-low
Excavations	1	1	1	2	2	40	13%	low
Roads, Mining Areas, Infrastructure	0	1	1	1	1	22	7%	low
Calcareous Interdune Straaten	7	6	10	9	10	253	79%	medium-high
Dune Savanna	7	5	10	9	10	245	77%	medium-high
Natural Woodland - Closed Shrubveld	7	5	8	7	10	223	70%	medium-high
Natural Woodland - Open Treeveld	7	5	10	9	10	245	77%	medium-high
Pans/ Impoundments	7	5	8	7	8	217	68%	medium-high

Figure 2.10 and Figure 2.11 show the floristic habitat type of the area as well as the floristic sensitivity of the area respectively.

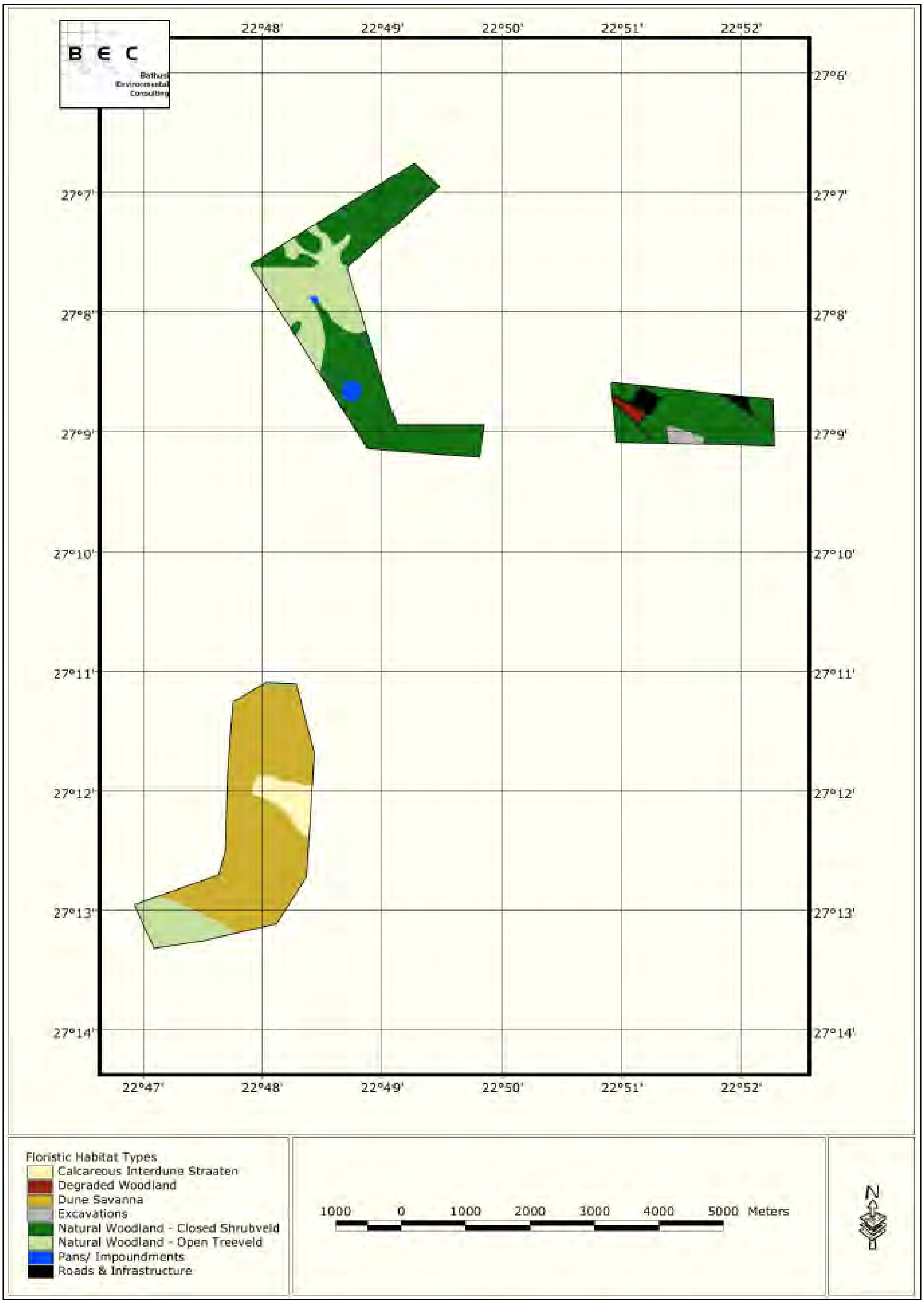


Figure 2.10 Habitat type of the area

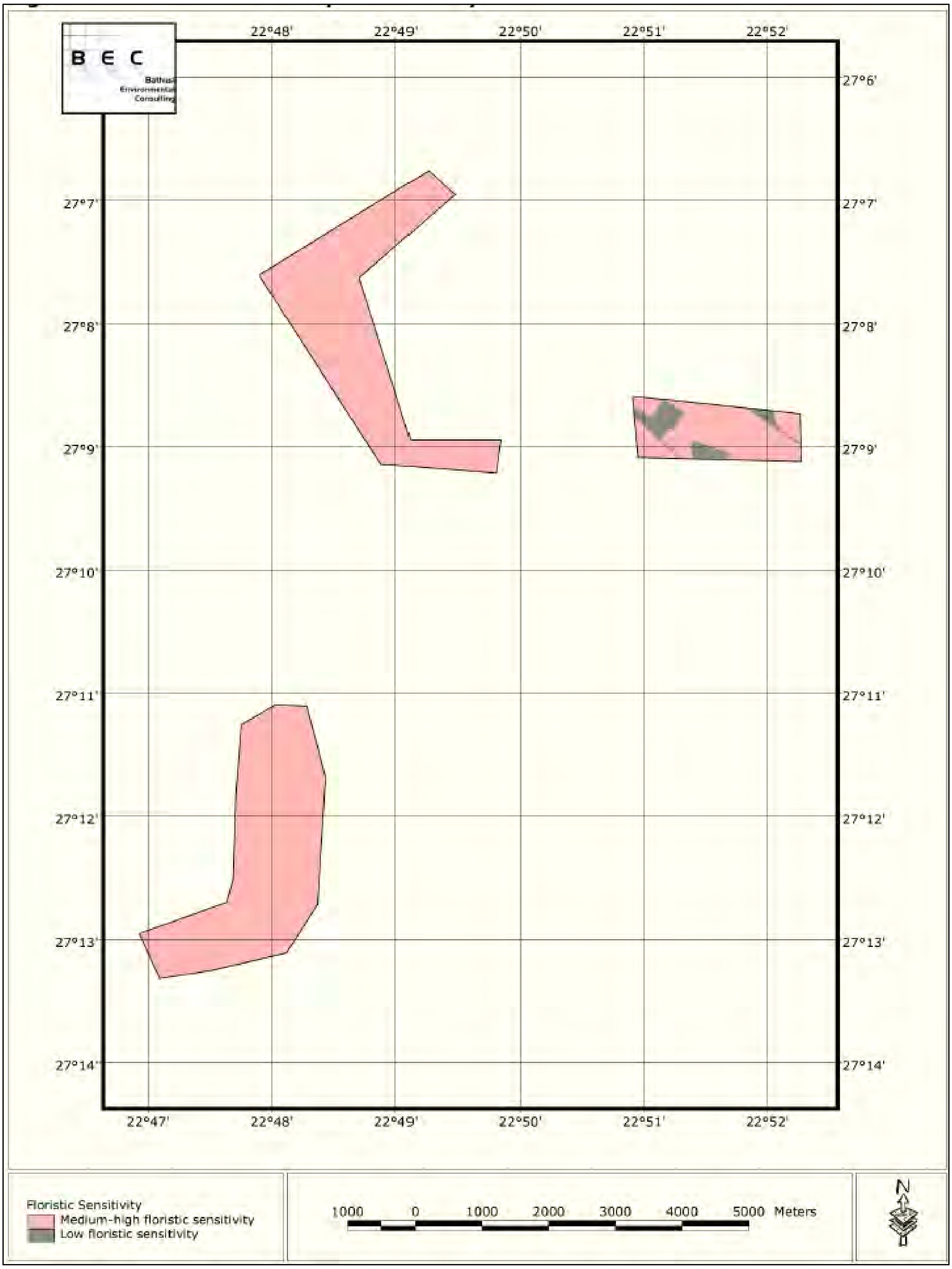


Figure 2.11 Floristic sensitivity for the area

2.7 Fauna

This information under this section was obtained from the Terrestrial Biodiversity Report compiled by Bathusi Environmental Consulting (Refer to Appendix B-3).

Detailed regional and scientific data on all faunal groups is lacking (notably for most of the invertebrate groups) and as a result only data sets on specific faunal groups allow for habitat sensitivity analyses based on the presence/ absence of sensitive faunal species (Red Data species) and their specific habitat requirements.

According to the report by FSI (2012), Animals known to be present in the Q-grids2722BA, 2722BB and 2722BD were considered potential inhabitants of the study area (all species known from the Northern Cape Province were included in the assessment to limit the known effects of sampling bias, except for birds which have been sampled extensively and the data for the Q-grids is accepted as accurate).

The faunal assessment is based on holistic ecological principles and includes qualitative surveys across all habitat types of the study area. This approach prefers holistic biodiversity conservation to single species conservation; the focus is therefore on sensitive faunal habitats rather than single Red Data species; these two approaches often coincide, but not always.

Animals found within the area’s boundaries were identified using visual observations, ecological indicators (tracks, dung, diggings, etc.), morphological characteristics (colour, size, shape etc.) and species-specific calls (especially for birds and frogs).

2.7.1 Faunal Diversity of the Area

The presence of 85 animal species was confirmed during the site investigation by means of visual sightings, tracks, scats, burrows and species-specific calls as well as camera and small mammal trapping. A total of 7 insects, 5 reptiles, 51 birds, and 22 mammals are recorded faunal groups in the area. Of the 85 species identified in the area, 7 were found to in the Red Data species list and these are Reddish-grey Musk Shrew; Bushveld Gerbil; Secretarybird; Leopard; White-backed Vulture; Martial Eagle; and Kori Bustard (Red in Table 2.8). Two alien species were also recorded on site and these are the Feral Domestic Cat, and the Donkey (highlighted in blue in the Table 2.10).

Additionally, invertebrates of 36 families were also confirmed to occur in the study area and these animals could only be identified to family level (Table 2.9). This includes invertebrates collected during the sweep net sampling.

Table 2.8 Animal Species recorded in the area

CLASS	ORDER	FAMILY	BIOLOGICAL NAME	COLLOQUIAL NAME
Insecta	Coleoptera	Chrysomelidae	*Macrocoma aureovillosa*	Furry Grassland Beetle
	Lepidoptera	Nymphalidae	*Danaus chryssipus*	African Monarch
			Vanessa cardui	Painted Lady
		Lycaenidae	*Cigaritis phanes*	Silvery Bar
		Pieridae	*Pinacopteryx eriphia*	Zebra White
			Catopsilla florella	African Migrant
	Hymenoptera	Formicidae	*Megaponera foetens*	Matabele Ant
Reptilia	Testudines	Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise
	Squamata	Elapidae	*Naja nivea*	Cape Cobra
		Viperidae	*Bitis arietans*	Puff Adder
		Lacertidae	*Pedioplanis namaquensis*	Namaqua Sand Lizard
		Varanidae	*Varanus albigularis*	Rock Monitor
Aves	Galliformes	Numididae	*Numida meleagris*	Helmeted Guineafowl
		Phasianidae	*Scleroptila levaillantoides*	Orange River Francolin
			Pternistis adspersus	Red-billed Spurfowl
	Falconiformes	Sagittariidae	***Sagittarius serpentarius***	**Secretarybird**
		Accipitridae	*Elanus caeruleus*	Black-winged Kite
			Gyps africanus	**White-backed Vulture**
			Micronisus gabar	Gabar Goshawk
			Polemaetus bellicosus	**Martial Eagle**
	Gruiformes	Otididae	***Ardeotis kori***	**Kori Bustard**
			Afrotis afraoides	Northern Black Korhaan
	Turniciformes	Turnicidae	*Turnix sylvaticus*	Kurrichane Buttonquail
	Charadriiformes	Charadriidae	*Vanellus armatus*	Blacksmith Lapwing
			Vanellus coronatus	Crowned Lapwing
		Pteroclidae	*Pterocles namaqua*	Namaqua Sandgrouse
	Columbiformes	Columbidae	*Streptopelia capicola*	Ring-necked Dove
			Spilopelia senegalensis	Laughing Dove
	Strigiformes	Tytonidae	*Tyto alba*	Western Barn Owl
		Strigidae	*Glaucidium perlatum*	Pearl-spotted Owlet
	Apodiformes	Apodidae	*Cypsiurus parvus*	African Palm-Swift
	Coliiformes	Coliidae	*Colius colius*	White-backed Mousebird
	Coraciiformes	Coraciidae	*Coracias caudatus*	Lilac-breasted Roller
	Upupiformes	Rhinopomastidae	*Rhinopomastus cyanomelas*	Common Scimitarbill

CLASS	ORDER	FAMILY	BIOLOGICAL NAME	COLLOQUIAL NAME
	Bucerotiformes	Bucerotidae	*Tockus nasutus*	African Grey Hornbill
			Tockus leucomelas	Southern Yellow-billed Hornbill
	Piciformes	Lybiidae	*Tricholaema leucomelas*	Acacia Pied Barbet
		Picidae	*Campethera abingoni*	Golden-tailed Woodpecker
			Dendropicos fuscescens	Cardinal Woodpecker
	Passeriformes	Malaconotidae	*Tchagra australis*	Brown-crowned Tchagra
		Laniidae	*Laniarius atrococcineus*	Crimson-breasted Shrike
		Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo
		Alaudidae	*Mirafra fasciolata*	Eastern Clapper Lark
			Calendulauda africanoides	Fawn-coloured Lark
		Pycnonotidae	*Pycnonotus nigricans*	African Red-eyed Bulbul
		Hirundinidae	*Ptyonoprogne fuligula*	Rock Martin
		Cisticolidae	*Prinia flavicans*	Black-chested Prinia
		Sylviidae	*Turdoides bicolor*	Southern Pied Babbler
			Sylvia subcaerulea	Chestnut-vented Tit-Babbler
		Zosteropidae	*Zosterops pallidus*	Orange River White-eye
		Sturnidae	*Acridotheres tristis*	Common Myna
		Muscicapidae	*Erythropygia paena*	Kalahari Scrub Robin
			Myrmecocichla formicivora	Ant-eating Chat
			Bradornis infuscatus	Chat Flycatcher
			Bradornis mariquensis	Marico Flycatcher
			Sigelus silens	Fiscal Flycatcher
		Nectariniidae	*Cinnyris mariquensis*	Marico Sunbird
		Ploceidae	*Plocepasser mahali*	White-browed Sparrow-
			Sporopipes squamifrons	SWceaalyv-efre athered Weaver
			Ploceus velatus	Southern Masked Weaver
		Estrildidae	*Uraginthus granatinus*	Violet-eared Waxbill
			Estrilda erythronotos	Black-faced Waxbill
		Viduidae	*Vidua regia*	Shaft-tailed Whydah
Mammalia	Insectivora	Soricidae	***Crocidura cyanea***	**Reddish-grey Musk Shrew**
	Lagomorpha	Leporidae	*Lepus capensis*	Cape Hare
	Rodentia	Sciuridae	*Xerus inauris*	Cape Ground Squirrel

CLASS	ORDER	FAMILY	BIOLOGICAL NAME	COLLOQUIAL NAME
		Gliridae	*Graphiurus ocularis*	Spectacled Dormouse
		Bathyergidae	*Cryptomys damarensis*	Damaraland Mole-rat
		Hystricidae	*Hystrix africaeaustralis*	Porcupine
		Muridae	***Tatera leucogaster***	**Bushveld Gerbil**
	Carnivora	Felidae	***Felis catus***	**Feral Domestic Cat**
			Panthera pardus	**Leopard**
			Caracal caracal	Caracal
			Felis silvestris	Wildcat
		Viverridae	*Genetta felina*	Feline Genet
		Hyaenidae	*Proteles cristata*	Aardwolf
		Canidae	*Canis mesomelas*	Black-backed Jackal
			Otocyon megalotis	Bat-eared Fox
	Tubulidentata	Orycteropodidae	*Orycteropus afer*	Aardvark
	Perissodactyla	Equidae	***Equus asinus***	**Donkey**
	Artiodactyla	Suidae	*Phacochoerus africanus*	Common Warthog
		Bovidae	*Strepsiceros zambiesiensis*	Zambezi Kudu
			Raphicerus campestris	Steenbok
			Antidorcas marsupialis	Cape Springbok
			Sylvicapra grimmia	Bush Duiker

Table 2.9 Invertebrate Families Recorded in the area

CLASS	ORDER	FAMILY	COLLOQUIAL NAME
Arachnida	Ixodida	Ixodidae	Hard Ticks
	Araneae	Eresidae	Family Nest Spiders
		Nephilidae	Golden Orb Web Spiders
		Thomisidae	Jumping Spiders
Insecta	Mantodea	Mantidae	Common Mantids
	Orthoptera	Tettigoniidae	Katydids
		Gryllidae	Crickets
		Pamphagidae	Heavy Grasshoppers
		Lentulidae	Wingless Grasshoppers
		Acrididae	Short-horned Grasshoppers
	Phasmatodea	Phasmatidae	Stick Insects
	Hemiptera	Coreidae	Twig Wilters
		Alydidae	Broad-headed Bugs
		Lygaeidae	Seed Bugs
		Pentatomidae	Stink Bugs

CLASS	ORDER	FAMILY	COLLOQUIAL NAME
		Fulgoridae	Lantern Bugs
		Issidae	Dumpy Planthoppers
		Cicadellidae	Leaf Hoppers
	Neuroptera	Chrysopidae	Green Lacewings
		Myrmeleontidae	Ant-lions
	Coleoptera	Carabidae	Ground Beetles
		Scarabaeidae	Scarab Beetles
		Buprestidae	Jewel Beetles
		Lycidae	Net-winged Beetles
		Cleridae	Chequered Beetles
		Nitidulidae	Pollen Beetles
		Coccinellidae	Ladybirds
		Tenebrionidae	Darkling Beetles
		Anthicidae	Ant Beetles
		Chrysomelidae	Leaf Beetles
		Bruchidae	Seed Weevils
		Curculionidae	Weevils
	Diptera	Muscidae	House Flies
		Hippoboscidae	Louse Flies
	Lepidoptera	Psychidae	Bagworms
	Hymenoptera	Formicidae	Ants

2.7.2 Red Data Faunal Species of the Area

A total of 92 Red Data animals are known to occur in the Northern Cape (butterflies, frogs, reptiles and mammals) and in the Q-grids 2722BA, 2722BB and 2722BD (birds) (Refer to Table 13 of the Study Report). Of the total RD animals in the area, 19 taxa are listed as Data Deficient (DD), 25 Taxa as Near Threatened (NT), 38 Taxa as Vulnerable (VU), 5 Taxa as Endangered (EN) and 5 as Critically Endangered (CE).

The estimate probability of occurrence (PoC) for the Red Data species for the area was conducted based on the size of the area, location of the area, the diversity and status of faunal habitat within the study area as well as other ecological characteristics; and the connectivity of the study area to surrounding faunal habitats. An assessment of the PoC for these animals yielded the following probabilities:

- 63 RD species have an estimated low PoC for the study area;
- 7 RD species have an estimated moderate-low PoC for the study area;
- 8 RD species have an estimated moderate PoC for the study area;

- 7 RD species have an estimated moderate-high PoC for the study area; and
- **7 RD species were confirmed to be present in the study area.**

In addition to the above-listed Red Data species of the Northern Cape and the Q-grids 2722BA, 2722BB and 2722BD, ten animal species (some overlap does occur) have protected status (NEMBA) within the Northern Cape (www.speciesstatus.sanbi.org). PoC for these species was estimated as seven (7) species having a low PoC and 3 species having a moderate-high PoC (Table 2.10).

Table 2.10 Protected species of Northern Cape Province

BIOLOGICAL NAME	ENGLISH NAME	NEMBA STATUS	PROBABILITY OF ASSESSMENT
Aonyx capensis	African Clawless Otter	protected	low
Atelerix frontalis	South African Hedgehog	protected	low
Ceratotherium simum	White Rhinoceros	protected	low
Circus ranivorus	African Marsh Harrier	protected	low
Crocuta crocuta	Spotted Hyaena	protected	low
Diceros bicornis	Black Rhinoceros	protected	low
Felis nigripes	Black-footed Cat	protected	moderate-high
Parahyaena brunnea	Brown Hyaena	protected	moderate-high
Spheniscus demersus	African Penguin	protected	low
Vulpes chama	Cape Fox	protected	moderate-high

2.7.3 Faunal Habitat Types of the Area

The close relationship between vegetation units and specific faunal composition has been noted in several scientific studies. For the purpose of this Report, the floristic units were considered representative of the faunal habitat types. Three habitat types were condensed from the botanical assessment (floristic assessment) of the area. These are the transformed faunal habitat; degraded faunal habitat; and natural faunal habitat.

2.7.3.1 Transformed Faunal Habitat

Within the area, small areas of transformed faunal habitat were encountered. These areas have lost all of the original ecological elements of the original regional vegetation communities and have no biodiversity value left (i.e. it does not constitute habitat for a significant number of natural faunal species). Transformed faunal habitats of the study area include excavations, roads and infrastructure. Because of the transformed nature of these areas found within the study area, low faunal sensitivities are ascribed to these portions.

2.7.3.2 Transformed Faunal Habitat

The degraded woodland and pans or impoundments of the study area are deemed degraded faunal habitat. This faunal habitat retained some of the ecological elements of the region and some intrinsic biodiversity value. This includes fragments of variable ecological integrity and biodiversity value (some fragments have lost more of the original ecological elements and likely faunal species, especially invertebrates, than others do). Most of the larger species (notably reptiles, birds and mammals) are likely to occur in the degraded faunal habitat as well as the natural faunal habitat of the study area. These fragments of degraded faunal habitat exhibit medium faunal sensitivities.

2.7.3.3 Transformed Faunal Habitat

The area included various natural terrestrial faunal habitats. Calcareous interdune straaten, dune savanna, natural closed shrubland and natural open treeveld differ slightly in terms of floristic attributes and consequently faunal community structure (most notably invertebrates), but significant overlap of larger animals' assemblage structures exist between the different natural faunal habitats of the study area. The natural faunal habitats of the area differ slightly in terms of status, diversity, linkage, Red Data species' presence and sensitivity, but these differences are insignificant. The seven Red Data species confirmed for the study area are unlikely to be found in only one or two of these habitat types and are expected to be found in most or all of these terrestrial habitat variations.
Due to the natural status of these habitats as well as the confirmed presence of seven Red Data species, the estimated faunal sensitivities of all the natural faunal habitats in the study area are estimated to be medium-high faunal sensitivity.

Table 2.11 shows the faunal sensitivity of the area. Figure 2.12 shows the faunal sensitivity of the area.

Table 2.11 Faunal Habitat Sensitivity of the area

Habitat Type	Status	Diversity	Linkage	Red Data	Sens	Ave	Sens Class
Calcareous Interdune Straaten	7	7	8	8	7	74%	medium-high
Degraded Woodland	5	6	5	4	6	52%	medium
Dune Savanna	8	7	8	8	7	76%	medium-high
Excavations	2	1	1	1	2	14%	low
Natural Closed Shrubveld	7	7	8	6	7	70%	medium-high
Natural Open Woodland	7	7	8	7	7	72%	medium-high
Pans or Impoundments	4	7	6	4	6	54%	medium
Infrastructure	1	1	1	1	2	12%	low

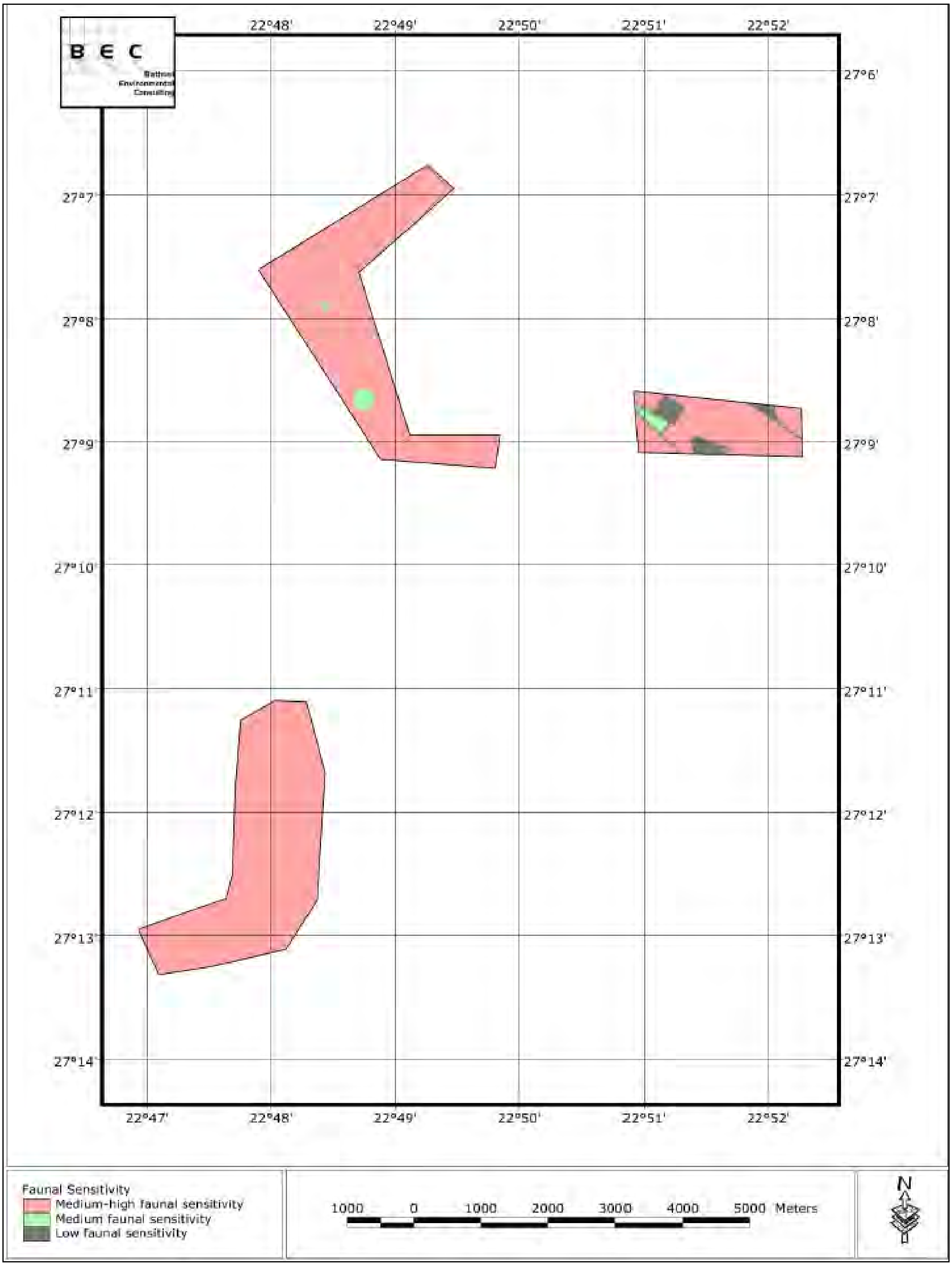


Figure 2.12 Faunal sensitivity of the area

2.8 Wetlands

The information in this section has been obtained from the Wetland Impact Assessment Report compiled by Wetland Consulting Services (Refer to Appendix B-4).

Wetlands were defined in terms of the NWA, as follows:
"*Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.*"

2.8.1 Wetland Delineation

The 1:50 000 topographical maps of the area indicate no natural water features as occurring on site, with no drainage lines, pan or dams indicated. However, the Atlas of Freshwater Ecosystem Priority Areas of South Africa (Nel et al., 2011) which incorporates the National Wetland Inventory (NWI) database of wetland areas indicates two large interdunal pans as occurring on site.

During the site visit undertaken in April 2012 it was however found that these so called "pans" indicated in the NFEPA database coincided with areas of shallow and exposed valley calcrete and that ***neither the soil nor the vegetation indicated these areas to be wetlands***.

The valley floor calcretes, through their more impervious nature compared to the surrounding sand dunes, do however influence and hinder the movement of surface water into and through the soil profile and can thus result in the pooling of water on the surface following heavy rainfall events. Generally surface water will persist for short periods only and be lost to evapotranspiration. However, in areas where surface water accumulates, small pans have formed within the interdune valleys that are expected to intermittently contain surface water for somewhat extended periods.

In total, six (6) such small ephemeral pans were identified on site, ranging in size from 30 – 100 m in diameter. Although the soils within these pans did not display typical wetland indicators such as mottling and gleying, the presence of cracked soil surfaces and signs of animals wallowing within the pans does indicate the extended presence of surface water within these areas. The vegetation of these pans also differed somewhat from the surrounding areas, again indicating the influence of water.

The three (3) pans located on the calcrete valley floors were dominated by stands of large *Olea europea* and *Ziziphus mucronata* trees. Although not wetland indicators, the presence of these trees indicates the greater availability of water in these areas, and the vegetation might be considered to represent a riparian fringe around the pans. The pan basins themselves, where well developed, were generally bare of vegetation.

The remaining three small pans were also mostly located within interdune valleys but were not characterised by a riparian fringe but rather by the absence of trees and shrubs within the pan basin and immediate perimeter and only a sparse grass cover, typically *Eragrostis viscosa* dominated. The list of vegetation species recorded on site is presented in Table 2.12.

Table 2.12 Mukulu Mine Wetland Study: Recorded Plant Species

SPECIES NAME	SPECIES NAME
Acacia erioloba	*Monechma divaricatum*
Acacia haemotoxylon	*Monechma genistifolium*
Acacia hebeclada	*Olea europea*
Acacia mellifera	*Peliostomum leucorrhizum*
Aptosimum marlothii	*Plinthus sericeus*
Aristida congesta	*Prosopis glandulosa*
Asparagus cooperi	*Rhigozum trichotomum*
Boscia albitrunca	*Salsola sp.*
Cenchrus ciliaris	*Schmidtia pappophoroides*
Chrysocoma obtusata	*Schmidtia kalahariensis*
Elephantorrhiza elephantina	*Senecio sp.*
Enneapogon cenchroides	*Senna italica*
Eragrostis echinochloidea	*Setaria verticillata*
Eragrostis lehmanniana	*Sporobolus fimbriatus*
Eragrostis pallens	*Stipagrostis uniplumis*
Eragrostis viscosa	*Tarchonanthus camphoratus*
Grewia flava	*Terminalia sericea*
Heliotropium lineare	*Urochloa oligotricha*
Lebeckia linearifolia	*Ziziphus mucronata*
Lycium cinereum	*Zygophyllum pubescens*
Megaloprotachne albescens	

Figure 2.13 shows the identified pans within the area.

In addition to the pans indicated in the NWI data, a further 3 small pans were identified based on a desktop examination of Google Earth imagery of the site. Together, these wetlands cover approximately 193.9 ha, or 1.4 % of the study area. No drainage lines or rivers were identified on site.

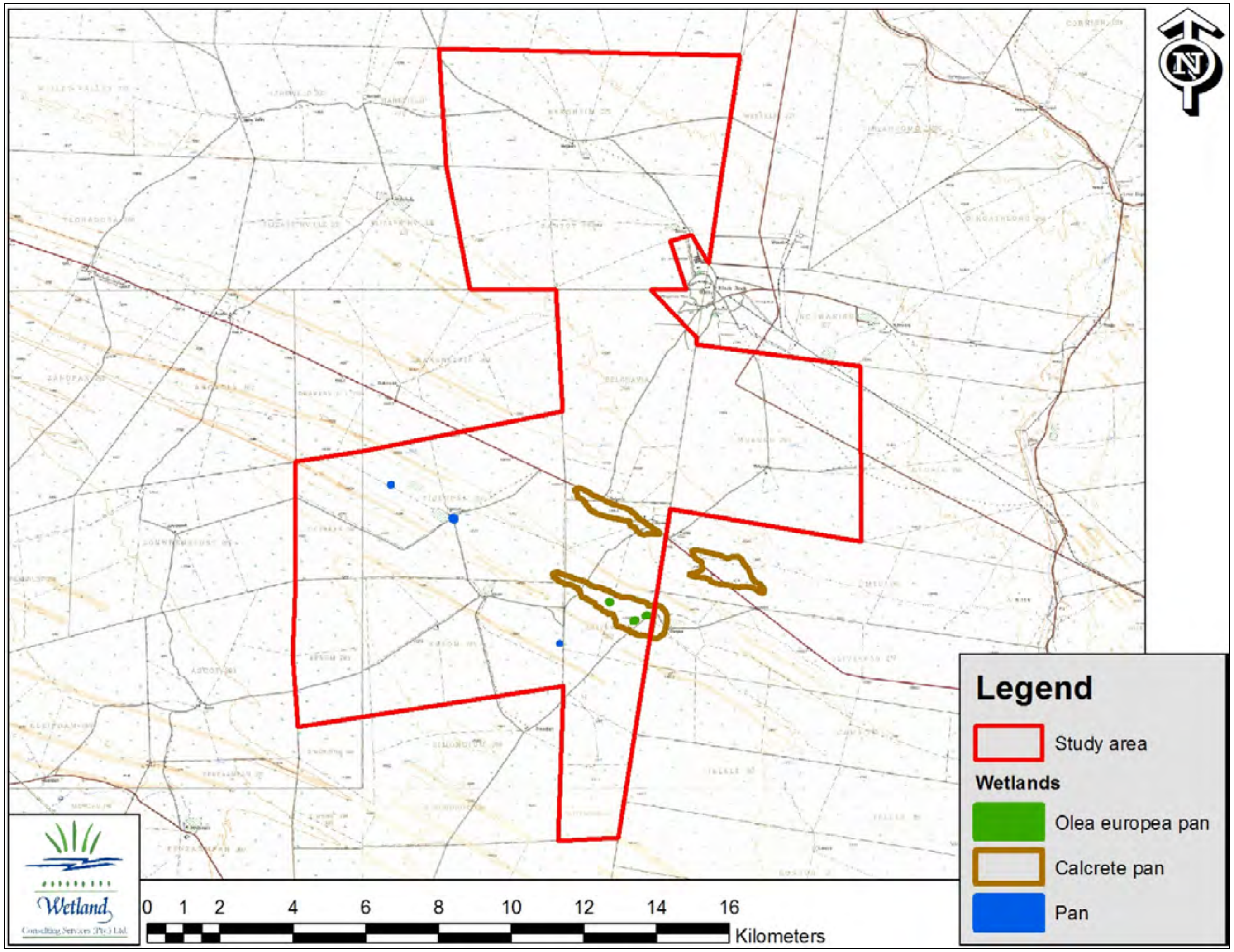


Figure 2.13 Wetland Delineation of Mukulu

The identified pans have been classified into three categories in Figure 2.13:

- Pans – these are small pans, only a few meters in diameter, which hold water for short periods after rainfall events that occur scattered within the terrestrial vegetation. They are mostly located within the valley floors. Water is kept within the pan basins either by underlying rock or calcrete that prevents the infiltration of water into the deep Kalahari sands that characterise most of the study area;
- Calcrete pans – These are the large pans also captured in the NWI data. It is speculated that these pans represent paleo-wetlands that were formed under a wetter climate in the past. The calcrete floor of the pans is considered to have formed due to the seasonal saturation of the soil profile. Under current conditions it is unlikely that the entire pan can become inundated following heavy rain, though the presence of the calcrete does prevent rainfall from infiltrating into the soil and small puddles are likely to form across the pan floor. Anecdotal evidence from local residents suggests that such pools can persist for several days to a week following heavy rain;
- Olea europea pans – Three small depressions lined by large Olea europea trees occur within the larger calcrete pan on site. These three depressions are likely to hold water most regularly and for the most extended period following rainfall.

The wetlands on site, though heavily grazed in places, are generally still expected to be in a largely natural condition, with little anthropogenic impact to the hydrology supporting the wetlands. Other than the important role these wetlands play in supporting biodiversity through the provision of surface water following rainfall and the different microhabitats provided by the vegetation they support, the wetlands are not expected to play a significant role in typical wetland functions such as water quality maintenance, flood attenuation or sediment trapping.

All of the pans are expected to derive their water from rainfall falling within the pan basin itself and within the pan catchment. The calcrete underlying the pan basins provides an aquitard that prevents the deeper infiltration of rainwater into the soil and allows for the surface accumulation of water. The absence of any defined drainage channels on site indicates that within the study area, most rainfall infiltrates the sandy soil horizons and little surface run-off is generated. The catchments of the pans are thus expected to be small, though available contour data being insufficient to actually delineate pan catchments. Given the flat nature of the terrain, it is unlikely that even 1 m contours would provide sufficient detail to determine the pan catchments.

As rainfall within the area is highly irregular and variable, and the pans do not have any connection to deeper groundwater, the occurrence of surface water within the pans will also be highly irregular and variable and is expected to be limited to short periods immediately following rainfall events.

As the pans have no defined outflow and no link to any adjacent or downslope water resources, the pans cannot perform any significant function in terms flood attenuation, water quality enhancement, erosion control or sediment trapping, functions which are typically attributed to wetland areas. The main function of the pans is considered to be biodiversity support through:

- The extended presence of surface water;
- Drinking water for game;
- Supports aquatic invertebrates;
- Habitat for waterfowl moving through the area during the wet season;
- Support of vegetation differing in species composition and structure from the surrounding landscape; and
- Provision of a range of microhabitats leading to an increase in diversity.

2.8.2 Present Ecological Status

The results of the Present Ecological Status (PES) assessment indicate that all of the pans on site are considered to be in a largely natural condition (PES category B), with only the Tigerpan Farm pan (Pan 5) which has been more significantly impacted by its close proximity to the farm yard and the presence of a farm road, though it still falls with the PES category B (largely natural). Refer to Figure 2.14 for the present ecological status of the pans/ wetland in the area.

Based on the small and isolated nature of the pans, all of the pans are placed in an ecological importance and sensitivity class of C, indicating moderate importance and sensitivity. Other than the role played in biodiversity support by the extended provision of surface water following rainfall events, the functions performed by the pans are extremely limited, and even the provision of surface water is erratic and unpredictable, being dependent as they are on rainfall. Refer to Figure 2.14 and Figure 2.15.

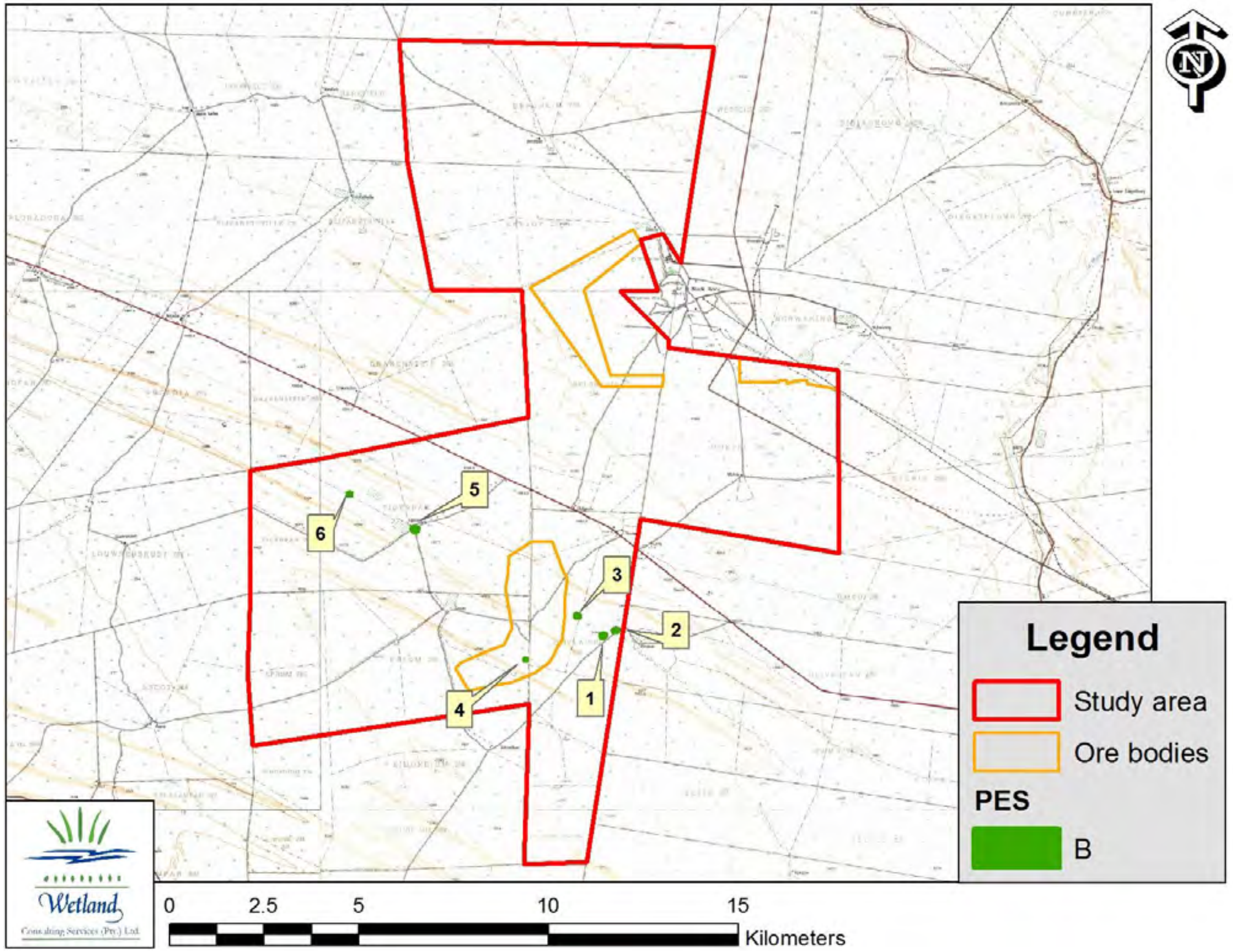


Figure 2.14 Present Ecological Status for the pand in the project area

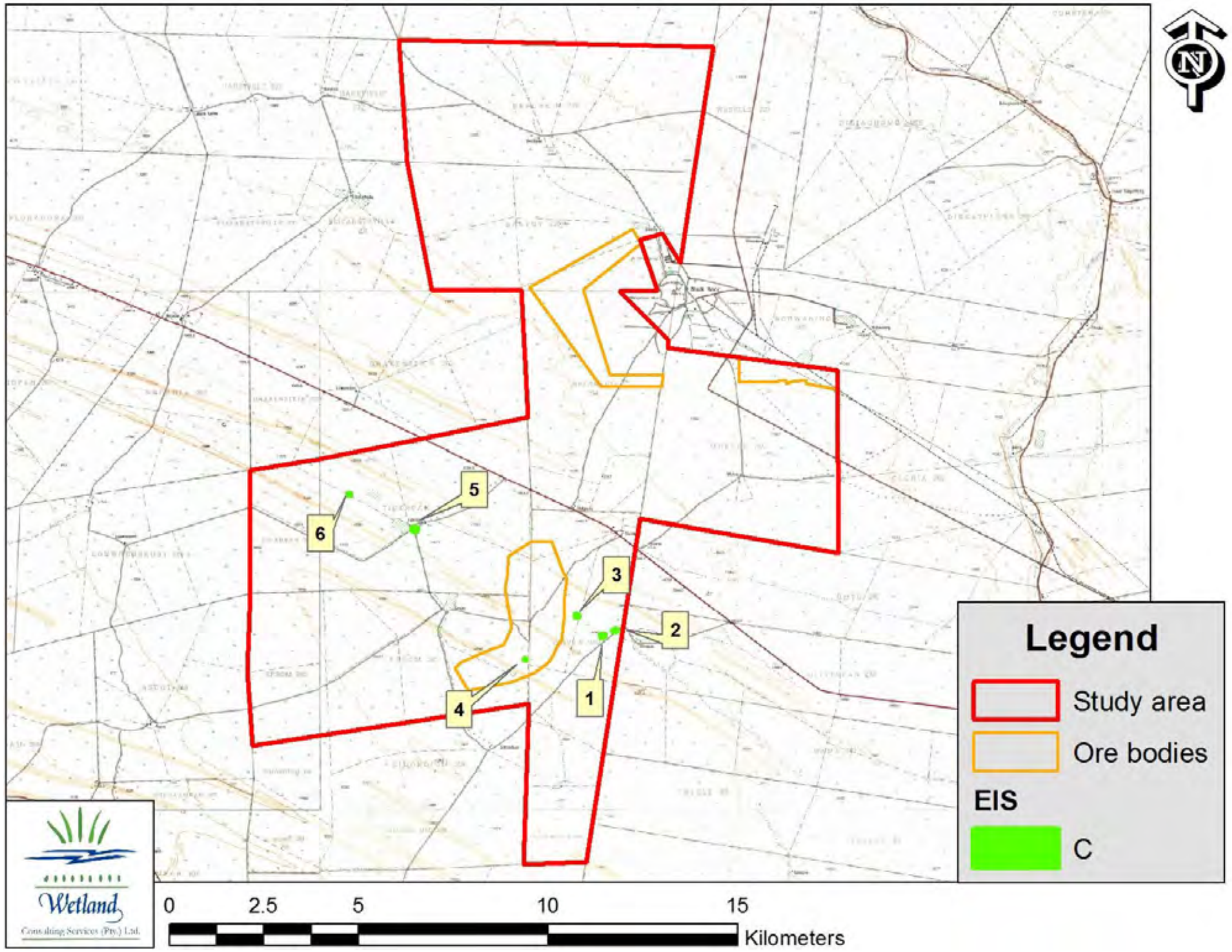


Figure 2.15 Ecological importance and sensitivity of the pans in the area

2.9 Sensitive landscapes

The information in this section was compiled using the Terrestrial Biodiversity report (Appendix B-3), the wetland Impact Assessment report (Appendix B-4), and the Hydrological Study report (Appendix B-2).

The sensitive landscapes identified within the project area comprise of pans (refer to Section 2.8), which are more than 1 000m from any planned infrastructure or activities.

Red Data flora and fauna species were identified within the project area (Refer to Section 2.6 and 2.7).

2.10 Surface water

The information in this section was obtained from the Hydrological Investigation Report (GCS, refer to Appendix B-2) and the Wetland Impact Assessment Reports (Wetland Consulting Services, refer to Appendix B-4).

The area is situated within low rainfall region; average annual precipitation is approximately 324mm of which only 0.8mm (0.24%) ends up as run-off out of the catchments, augmented by the sandy nature of the soils facilitate infiltration and flat topography that prevent run-off. With this arid climate, there is thus extremely limited opportunity for wetland formation and no drainage lines are indicated within the study sites. The Ga-Mogara River is situated approximately 5km to the east of the site (Refer toFigure 2.16).

This river drains into the Kuruman River situated approximately 3km to the north. Both these rivers are indicated to have an extremely intermittent flow period, only flowing subsequent to significant flash flood periods.

It is expected that runoff from local areas will be accurate represented by the results of WR2005 simulations. Approximately 1% of rainfall will run off and reach local river systems. The region contains large endoreic areas, where runoff is expected to seep into the earth or form temporal pools and be lost to evaporation.

2.10.1 Catchment delineation

The area falls within the Orange River Catchment (Primary Catchment D), with the affected quaternary catchments being D41K and D41M. These catchments receive on average approximately 324 mm of annual rainfall, of which approximately 0.8 mm (0.24 %) ends up as run-off out of the catchments (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990).

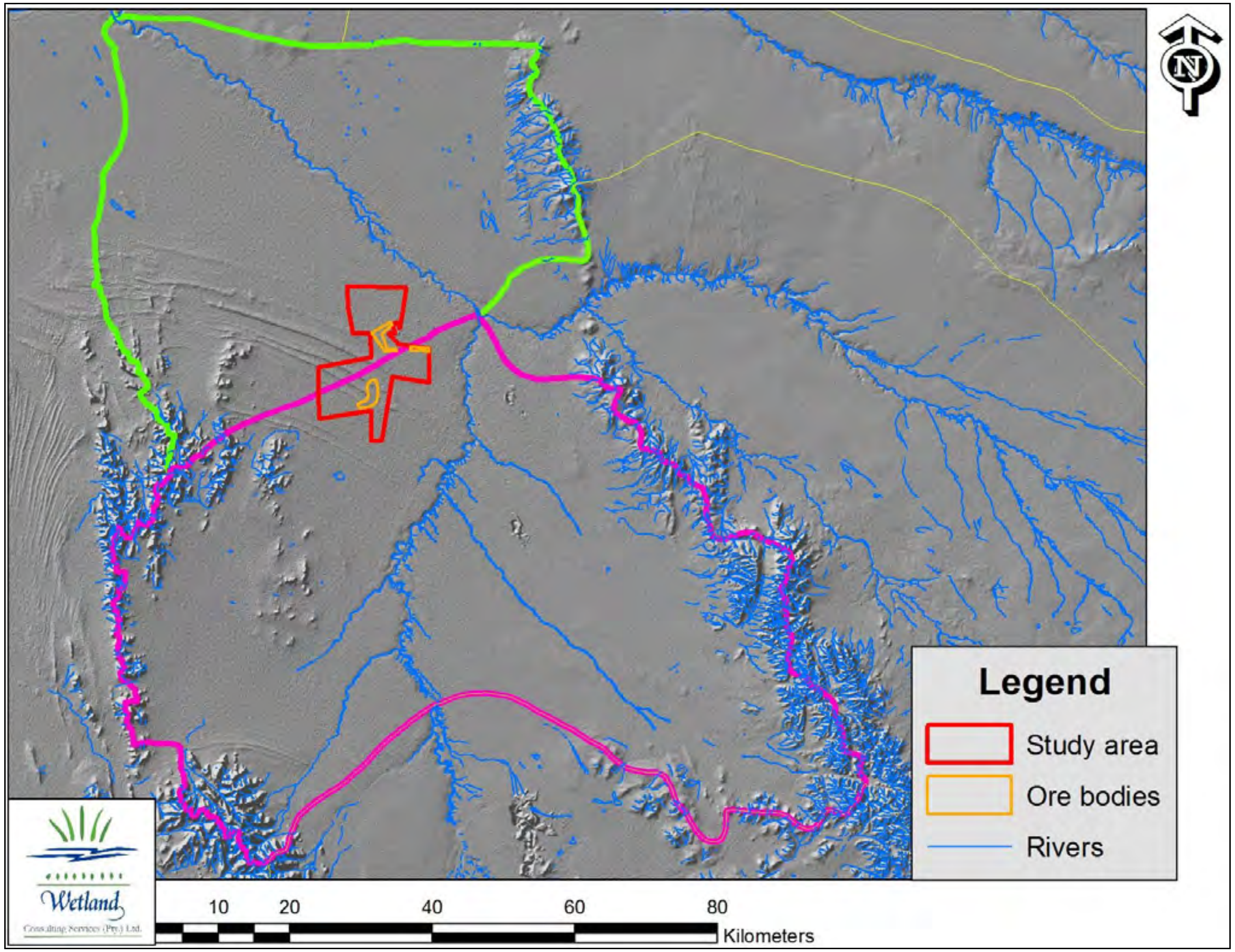


Figure 2.16 Map showing the study area in relation to the Quaternary Catchment D41M (green) and D41K (pink)

2.10.2 Normal dry weather flow

The area is a desert with no flow during dry period.

2.10.3 Flood flows

At the sites of surface infrastructure and mining activities, surface runoff is modelled as localised floods. While much of the rainfall that falls on the permeable soil surfaces is likely to seep into the ground and not run off, water falling on roads, roofs and paved surfaces will run off and add to expected flood flows. It is assumed that 5% of the mining sites will be sealed and rain that falls is likely to run off directly. The calculations methods are provided in the Hydrological report (Appendix B-2).

Local run off patterns of the area are described in Figure 2.17.

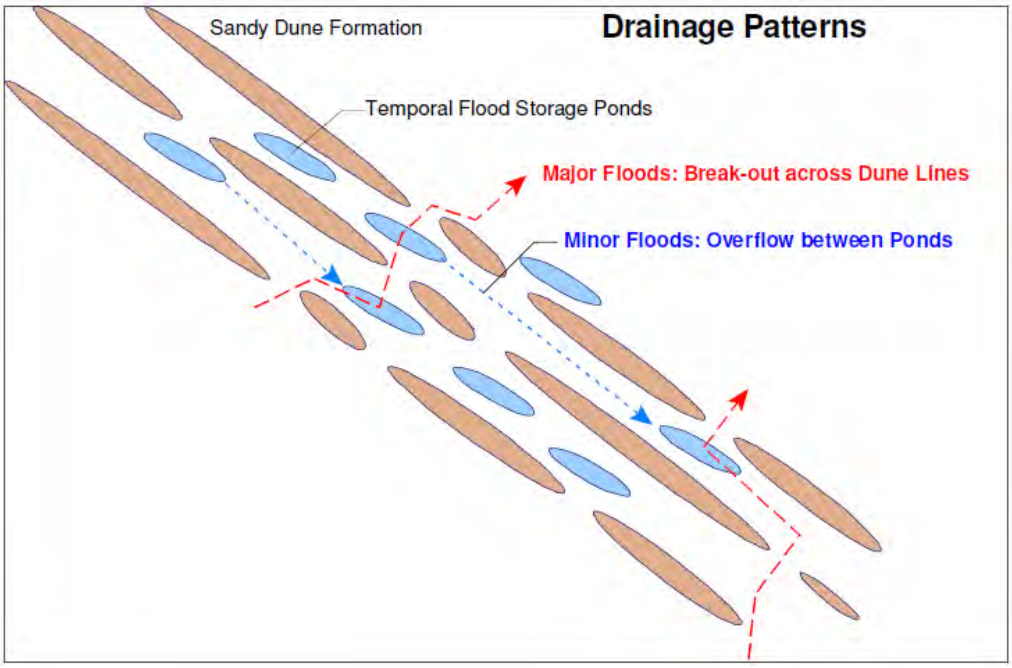


Figure 2.17 Runoff drainage patterns of the area

The flood runoff calculated for a 1hour storm over an area 48ha (dirty area) is shown in Table 2.13.

Table 2.13 Calculated Storm-water Runoff for Mukulu area

RETURN PERIOD	PEAK 24 HR RAIN (MM)	RUNOFF (MM) VELD	RUNOFF (MM) SITE	RUNOFF (M^3)	FLOOD (M^3/SEC)
1	40.0	0.0	2.0	1680	0.9
2	50.4	0.0	2.5	2117	1.2
5	68.4	0.0	3.4	2873	1.6
10	86.2	6.1	10.4	8726	4.8

RETURN PERIOD	PEAK 24 HR RAIN (MM)	RUNOFF (MM) VELD	RUNOFF (MM) SITE	RUNOFF (M^3)	FLOOD (M^3/SEC)
20	108.6	14.1	19.5	16 408	9.1
50	147.4	28.8	36.1	30 362	16.9
100	185.7	44.1	53.3	44 805	24.9
200	233.9	64.2	75.9	63 766	35.4
500	317.5	101.1	116.9	98 235	54.6
1000	400.0	139.4	159.4	133 937	74.4

2.10.4 Flood lines

There is no sustained flow within the project area, therefore no floodlines were determined.

2.10.5 Surface water quality

No surface water samples were collected as over the entire area surface water is a temporal occurrence only after heavy rains.

2.11 Ground water

2.11.1 Aquifer description

It is likely that the following two aquifers exist within the proposed mining area, of which the upper aquifer is located within the Kalahari Formation:

- The perched, primary inter-granular, unconfined sand and gravel layers of the Kalahari Formation. The lower thick red clay layer with an average thickness of 30 m acts as an aquiclude;
- Fractured basement aquifer with secondary porosity associated with fracturing. The fractured basement aquifer can be classified as the secondary source aquifer in this instance. It is generally considered low yielding and display intergranular and fractured regime, which indicate mainly within the fractures of the rock.

The perched aquifers have the following characteristics:

- Porosity (1 – 25%);
- Transmissivity (T = 0.4 - 1.5 m^2/day);
- Variable storage but usually less than 1%; and
- 0 – 6 m saturated thickness.

This aquifer is of great importance due to the higher storage capacity. Rainwater recharge to the aquifer can be stored. It can then slowly recharge the deeper fractured aquifer.

2.11.2 Aquifer parameters

Constant rate aquifer testing was conducted on the 9th May 2012 on monitoring borehole BH 2. Monitoring boreholes BH 1 & 3 were dry when drilled and it was therefore decided not to aquifer test these two boreholes.

The borehole (BH 2) was pumped at an initial abstraction rate of 0.33 l/s. The time period for the constant rate test was about 100 minutes, whereafter the water level dropped to the pump intake.

The aquifer test data was interpreted using the Cooper-Jacob and Theis methods, for drawdown data. Table 2.14 shows a summary of the aquifer test results, and the aquifer test plots and interpretation of the data are presented in the Hydrogeological Investigation Report (Appendix C-1).

Table 2.14: Aquifer Test Information

BH ID	SWL	Abstraction Rate	Duration of Test	Maximum Drawdown	Recovery	Transmissivity (m^2/d)	
	(mbgl)	(l/s)	(min)	(m)	%	Cooper-Jacob Method	Theis Method
Monitoring BH 2	56.1	0.33	100	63	93	1.4064	1.3004

SWL=Static Water Level

2.11.3 Baseline Groundwater Conditions

A hydrocensus study was conducted in May 2012 by GCS. A total of 33 boreholes were visited. The hydrocensus information is presented in Table 2.15 and Figure 2.18 on the Hydrogeological report (Appendix C-1) and presents the borehole locations on a locality map. It was found that all of the boreholes were used mainly for stock watering and domestic purposes. Three of the boreholes were blocked. No springs were found within the study area.

Water samples were taken where possible from all exploration boreholes, with the aid of a bailer. Privately-owned boreholes were also sampled wherever it was possible.

2.11.4 Groundwater levels

The average depth of the piezometeric water level is about 55 m below surface. The topography of the study area is relatively flat and the general slope is in a north-easterly direction. During the hydrocensus survey, water levels were measured in all open and accessible exploration boreholes. All these boreholes are cased with solid steel casing right through the thick lower clay layer of the Kalahari Formation. This makes them ideal for measuring the deeper water level associated with the deeper secondary fractured aquifers.

From the results it is evident that there are deeper aquifers present and that regional dewatering, due to neighbouring mining activities to the north, has dewatered these aquifers to a certain extent. To prove or disprove that a shallower perched aquifer exists, associated with the pebble layer lying on top of the thick clay layer of the Kalahari Formation, three shallow monitoring boreholes were drilled surrounding the surface infrastructure of the proposed Mukulu Mine. The positions of these new monitoring boreholes are presented in Figure 2.18. In one of these boreholes there was a water strike at a depth of 61 m, associated with the pebble aquifer on top of the clay layer.

2.11.5 Groundwater quality

Fifteen (15) groundwater samples were collected from the mine property and the neighbouring properties during the May 2012 hydrocensus. The sampling method and procedures are described in Hydrogeological Investigation Report (Appendix B-1). The samples were sent to Clean Stream Scientific Services (Pty) Ltd in Pretoria for analysis.

The results of analysis shows that groundwater in this area is generally of good quality with a primarily calcium-magnesium and bicarbonate character, indicating recently recharged groundwater. Only samples MKA 11 and HBH 1 plot in the sodium/chloride field of the diamond. Borehole BH 2 plots in the contaminated NO_3 and/or SO_4 field and indicates that this borehole is contaminated with water originating from neighbouring mining activities. Water sample also shows elevated sodium (Na) and chloride (Cl) values.

The following parameters exceeded the relevant standards in the specific boreholes:

- Mn, naturally occurring in the following boreholes: MKA 6, MBH 1 and TBH 2.
- Of the trace elements, Strontium (Sr) was the most commonly found in the water samples. No natural explanation for this phenomenon can be given at this stage, and future monitoring can verify these results. Strontium (Sr) values greater than 1 mg/L were detected in boreholes SBH 2 and BH 2.

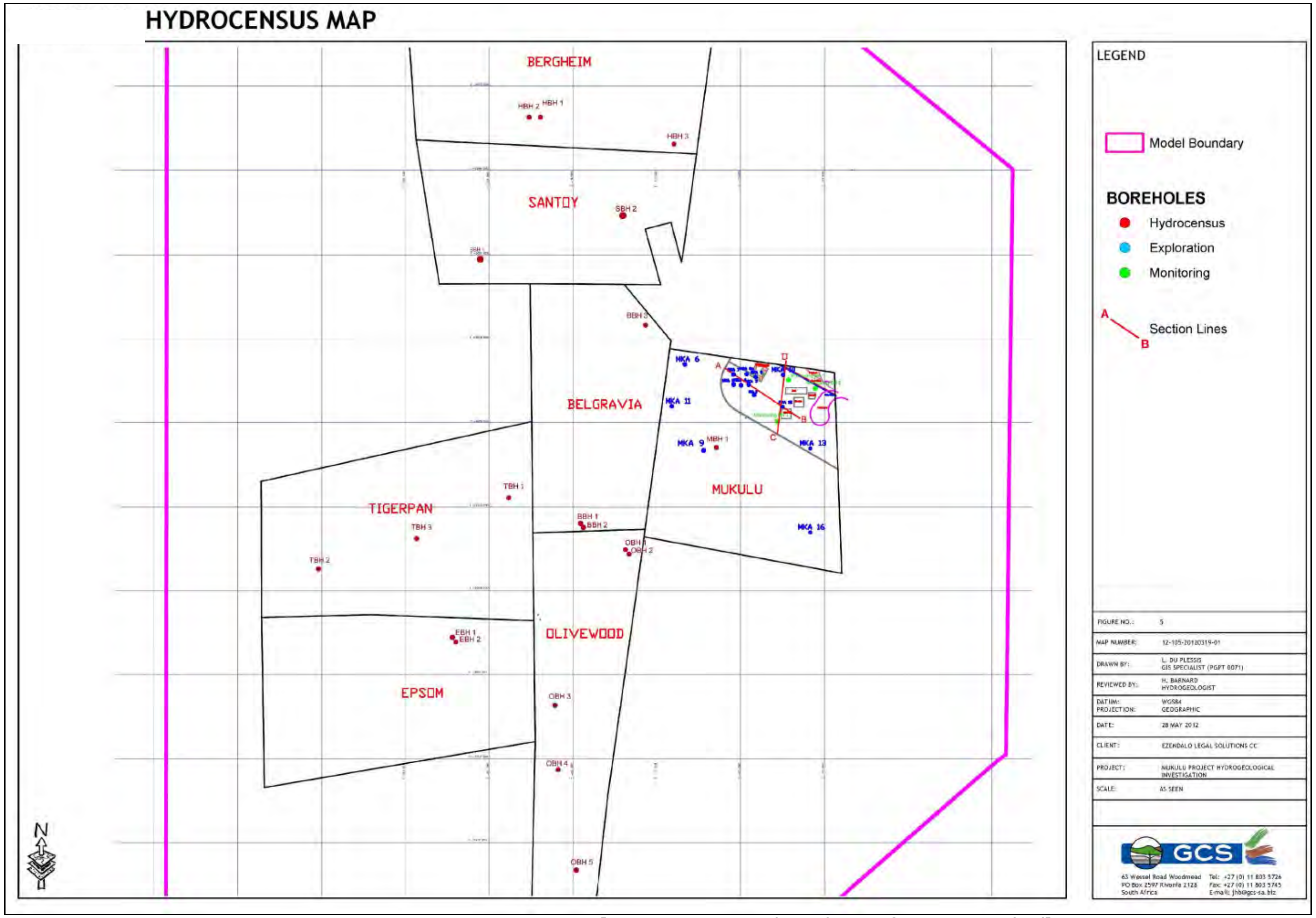
The hydrochemical results are presented in Table 2.15. The results were compared with the Department of Water Affairs (DWA) South African Water Quality Guidelines (SAWQG) Volumes 1, 4, 5 and 7 as well as the South African National Standard for Drinking Water (SANS 241:2006).

Table 2.15 Groundwater Chemistry Results

Mukulu Mine																	SANS 241:2006 Drinking Water Standards		
	SAWQG Target Values	HBH 1	HBH 3	SBH 1	SBH 2	BBH 1	EBH 1	BH 2	MKA 11	MKA 6	MBH 1	OBH 2	OBH 5	TBH 1	TBH 2	TBH 3	Class I (recommended operational limit)	Class II (max. allowable for limited duration)	Class II water consumption period, max.
pH-Value at 25 ° C	6.0-9.0	8.92	7.19	7.24	7.56	8.87	8.64	7.16	8.88	8.65	8.63	8.7	8.7	8.72	6.99	7.57	5 - 9.5	4 - 10	No Limit
Conductivity at 25° C in mS/m	0-70	79.6	78.4	90.7	114	71.6	70.8	308.6	61.3	58.2	120.3	64.3	85.7	65.5	44.3	62.5	<150	150 - 370	7 years
Total Dissolved Solids	0-450	495	488	533	695	441	456	3273	372	368	1018	451	673	445	235	397	< 1000	1000 - 2400	7 years
Calcium as Ca	0-32	19.391	352.7	94.85	107.46	64.18	84.10	389.0	6.266	49.267	74.925	67.70	97.52	72.18	28.38	55.66	<150	150 - 300	7 years
Magnesium as Mg	0-30	13.245	41.924	41.12	66.85	34.44	31.63	327.9	18.34	34.96	63.24	33.5	47.882	30.85	16.13	29.36	<70	70 - 100	7 years
Total Hardness as CaC	0-100	103	54.44	406	544	302	340	2322	91	267	448	307	441	307	137	260			
Sodium as Na	0-100	152.37	54.44	50.95	66.21	52.21	51.04	376.37	104.99	41.7	189.19	51.1	76.64	50.53	34.95	56.42	<200	200 - 400	7 years
Potassium, K	0-50	4.682	8.466	8.568	9.867	8.072	8.28	43.51	10.43	7.16	12.89	7.65	14.15	7.597	4.99	8.89	<50	50 - 100	7 years
Total Alkalinity as $CaCO_3$	NS	253.1	352.7	248.2	360.8	256.6	235.9	234	208.3	240.9	197.4	242.6	273.4	245.6	179.1	299.1			
Bicarbonate HCO_3 as $CaCO_3$	NS																		
Chloride as Cl	0-100	67.9	68.5	92.9	163	68	62.9	1628	92.5	56.6	380.9	81.4	223.4	53.9	24.8	33	<200	200 - 600	7 years
Sulphate as SO_4	0-200	80.89	36.46	62.35	34.7	51.86	50.29	278.66	13.66	24.6	172.07	56.97	41.25	65.16	18.37	28.33	<400	400 - 600	7 years
Nitrate as NO_3	0-26	4.305	3.066	33.14	30.87	7.93	25.81	88.70	0.39	8.88	5.84	7.63	7.90	17.74	0.15	5.92	<10	10 - 20	7 years
Fluoride, F	0-1	0.926	0.493	0.292	0.384	0.28	0.373	0.463	0.381	0.258	0.396	0.253	0.406	0.363	0.282	0.657	<1	1.0 - 1.5	1 year
Boron, B	NS	1.424	0.213	0.124	0.208	0.18	0.107	1.012	0.618	0.13	0.396	0.129	0.209	0.137	0.083	0.185			
Chromium as Cr	NS	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.1	0.1 - 0.5	3 months
Aluminium as Al	0-0.15	<0.006	<0.006	<0.006	<0.006	0.12	<0.006	<0.006	0.046	<0.006	<0.006	<0.006	0.025	<0.006	<0.006	0.822	<0.3	0.3 - 0.5	1 year
Manganese, Mn	0-0.05	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	0.056	<0.001	0.122	0.12	0.025	<0.00	<0.	0.1	<0.00	<0.1	0.1 - 1.0	7 years

		1	1	1	1	1	1						1	001	19	1			
Iron, Fe	0-0.1	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.2	0.2 - 2	7 years
Vanadium as V	0-0.1	0.013	0.008	0.006	0.01	0.008	0.008	0.011	-0.003	-0.003	0.011	0.009	0.004	0.007	-0.003	0.009	<0.2	0.2 - 0.5	1 years
Strontium, Sr	NS	0.37	0.743	0.655	1.074	0.552	0.526	4.226	0.096	0.439	0.919	0.551	0.797	0.525	0.224	0.484			
Lead, Pb	0 - 0.01	<0.01	<0.01	0.056	0.051	<0.01	<0.01	0.014	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	0.02 - 0.05	3 months
Zinc, Zn	0 - 3	<0.004	<0.004	0.074	<0.004	0.477	0.065	0.011	<0.004	<0.004	<0.004	<0.004	0.074	0.026	0.034	<0.004	<5.0	5.0 - 10	1 year

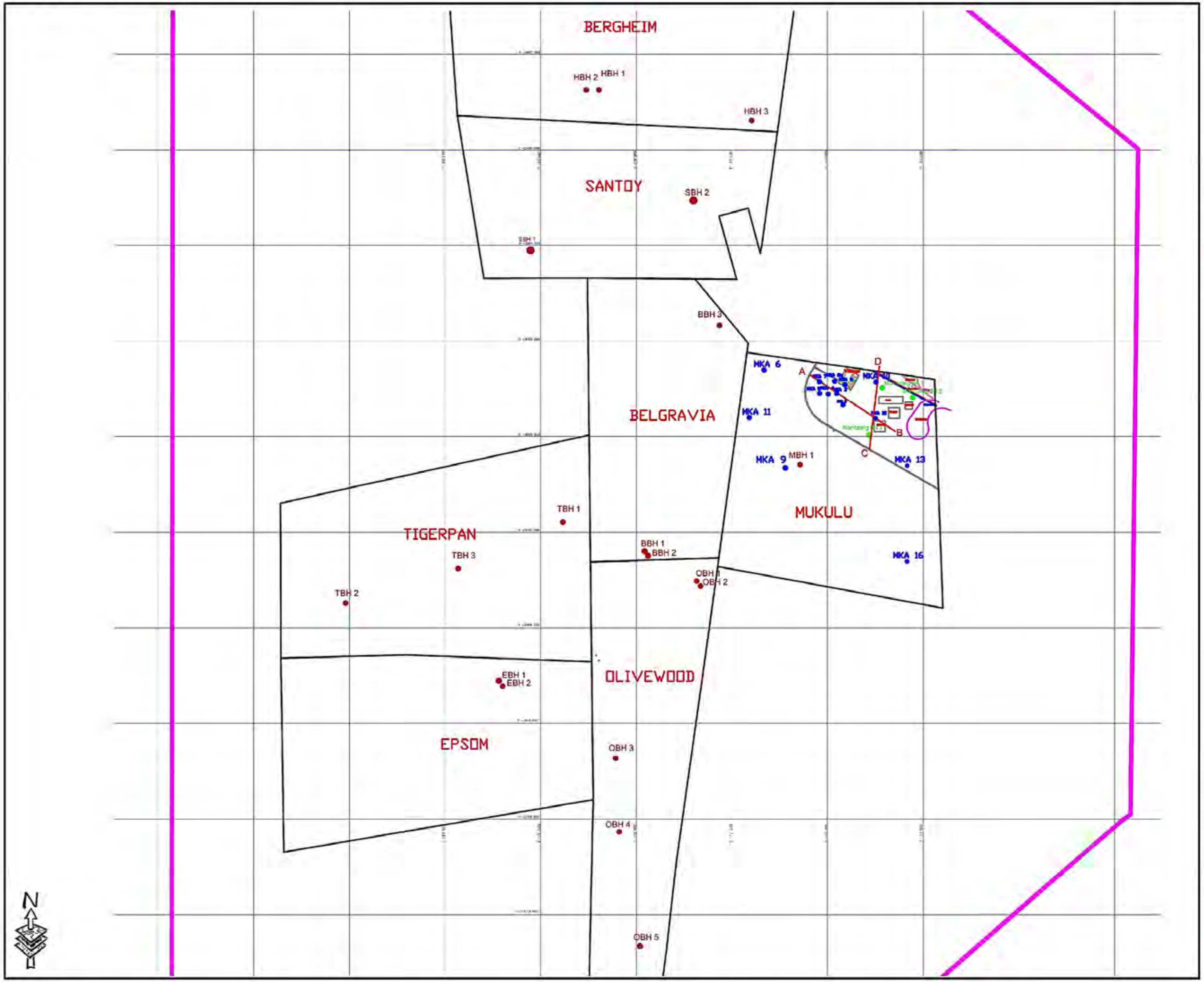
Value exceeds target concentrations for SAWQG for Domestic Use
Value exceeds SANAS:2006 Drinking Water
All values in mg/L or otherwise stated



[Figure is not to scale- refer to A3 Figure attached]

Figure 2.18 Mukulu Mine Groundwater Hydrocensus Results

HYDROCENSUS MAP



LEGEND

Model Boundary

BOREHOLES

- Hydrocensus
- Exploration
- Monitoring

A–B Section Lines

FIGURE NO.:	
MAP NUMBER:	12-105-20120319-01
DRAWN BY:	L. DU PLESSIS GIS SPECIALIST (PGPT 0071)
REVIEWED BY:	H. BARNARD HYDROGEOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	28 MAY 2012
CLIENT:	EZENDALO LEGAL SOLUTIONS CC
PROJECT:	MUKULU PROJECT HYDROGEOLOGICAL INVESTIGATION
SCALE:	AS SEEN

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2.11.6 Aquifer Potential

The drilling of monitoring boreholes, evaluation of the geology and evaluation of hydrocensus information revealed that the aquifer potential for the study area is limited to discrete primary and secondary aquifers. An assessment of the groundwater regime within the study area has been conducted on a number of variables, namely:

- Recharge Area
- Recharge (natural or artificial)
- Aquifer Classification

2.11.6.1 Recharge Area

The main source of recharge is recognized from the groundwater flow patterns and hydrochemistry. The groundwater flow patterns and hydrochemistry usually indicate the main source areas of recharge.

2.11.6.2 Rainfall-related recharge

It was assumed that rainfall is constant over the entire catchment. The effective groundwater recharge from rainfall is the portion of rainfall that reaches the groundwater rest level and excludes surface water run-off, evapotranspiration and soil moisture. The effective rainfall-recharge is dependent on catchment geology, soils and surface run-off and stream morphology.

Recharge, as used to calibrate the groundwater flow model, was calculated at 1% of MAP and will vary depending on the annual rainfall. Groundwater recharge, calculated using the chloride (Cl) method, gives rainfall recharge figures varying between as high as 1.7% and as low as 0.25%. The upper thick clay layer of the Kalahari Formation plays a major role in the percentage of rainwater that is allowed to reach the underlying aquifers.

2.11.6.3 Artificial recharge

High nitrate (NO_3) and sulphate (SO_4) in borehole BH2 indicate that contaminated water originated from mining activities has reached the upper perched aquifer. Further studies will indicate if the source of contamination is either a single source or a diffused source.

2.11.6.4 Aquifer Classification

The study area is situated on an intergranular, primary type of aquifer associated with the pebble layer, on top of the thick clay layer of the Kalahari Formation. A deeper secondary aquifer is associated with fracturing and faulting within the lithologies of the Transvaal Supergroup. The groundwater quantity and quality is variable. Borehole yields in the area are normally low, in the order of 0.1 – 0.5 l/s. All the above factors indicate that the groundwater potential of the study area is low.

2.11.7 Geochemical analysis

Geochemical analyses for the Mukulu Mine included acid base accounting (ABA) and static leaching tests of selected lithologies. Acid-base Accounting (ABA) is a static test where the net potential of the rock in order to produce acidic drainage is assessed. This test is an important first order assessment of the potential leachate that could be expected from the rock material.

2.11.7.1 Acid Base Accounting

The description of the different ABA components and screening methods are provided in the Hydrogeological Report (Appendix B-1).

The Acid-base Accounting (ABA) tests for the area were performed by Waterlab (Pty) Ltd, Pretoria. With regards to the potential of the rock to produce acid, the following are the outcome:

- The percentage sulphide (%S) of almost all samples was very low except one ore sample with a %S of 0.29;
- The neutralization potential of the samples was significantly higher than the acidification potential; and
- Because of the low %S and the high neutralisation potential, the samples are not expected to produce acid mine drainage (AMD) over the long-term.

The ABA results are presented in Table 7 of the Hydrogeological report (Appendix B-1)

2.11.7.2 Static leaching tests

Leaching tests identify the elements that will leach out of waste but do not reflect the site-specific concentration of these elements in actual seepage as a different water/rock ratio and contact time will be present in the field. Refer to the Hydrogeological report (Appendix B-1) for the leaching test methods.

A total of 6 (of the 9) samples were submitted for leach testing. System parameters and anions measured in the leachate are listed in Table 10 and 11 of the Hydrogeological report (Appendix B-1), with the ICP-OES analytical results listed in Table 12 and 13 of the report. Leaching tests for the site were performed by Waterlab (Pty) Ltd in Pretoria. From the leaching test results, the following observations could be made:

- The pH in the distilled water extraction was neutral to slightly alkaline;

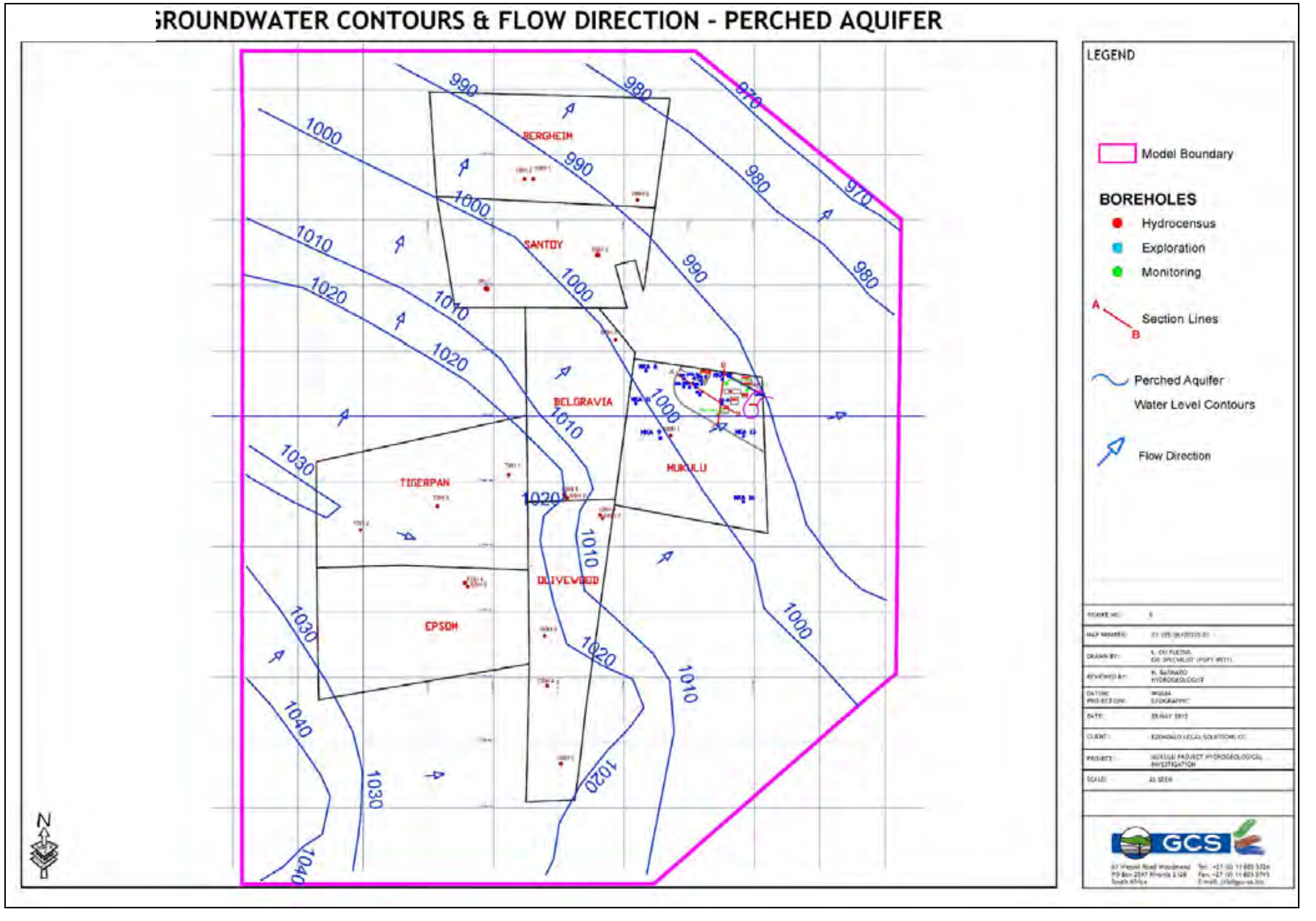
- Total alkalinity was the major component that leached out of the rock in the distilled water leach. This is the result of the high carbonate mineral content of the samples;
- Very few metals leached out in the distilled water leach. Notable is arsenic (As) that leached out at slightly elevated concentrations in three samples. Manganese (Mn) leached out from one sample at marginally elevated concentrations. However, the rock:water ratio was very high at 1:4 for the distilled water leach. If a rock:water ratio of 1:20 was used (as with the ARLP test), arsenic and manganese would most probably not be elevated in the leachate;
- The pH in the ARLP leach was near neutral (slightly acidic);
- Total alkalinity was again the major component that leached out from the rock in the ARLP leach. This is the result of the high carbonate mineral content of the samples;
- Very few metals leached out in the ARLP water leach. Manganese leached at elevated concentrations from all samples. Both aluminium and arsenic leached from only one sample at slightly elevated concentrations; and
- Overall, the samples showed no potential to generate acid-mine drainage. Very few metals would be present in neutral to alkaline seepage from the mine, except aluminium, iron and manganese. Under slightly acidic conditions, manganese would significantly leach out from the rock material. Arsenic could leach out from the rock in small quantities but it is not foreseen that it would reach non-compliant concentrations.

2.11.8 Groundwater flows

For the Mukulu Mine it was proven that an upper perched aquifer exists, with a water level around 55 m below surface, as well as a deeper water level associated with deeper aquifers, which have been dewatered to a certain extent. Figure 2.19 and Figure 2.20show the regional water level contours and flow directions for the upper perched aquifer, as well as the deeper water level due to mine dewatering activities.

Groundwater flow direction for the upper perched aquifer mimics the surface topography and is in a north-easterly direction. The groundwater flow gradient is very shallow and almost flat throughout the area.

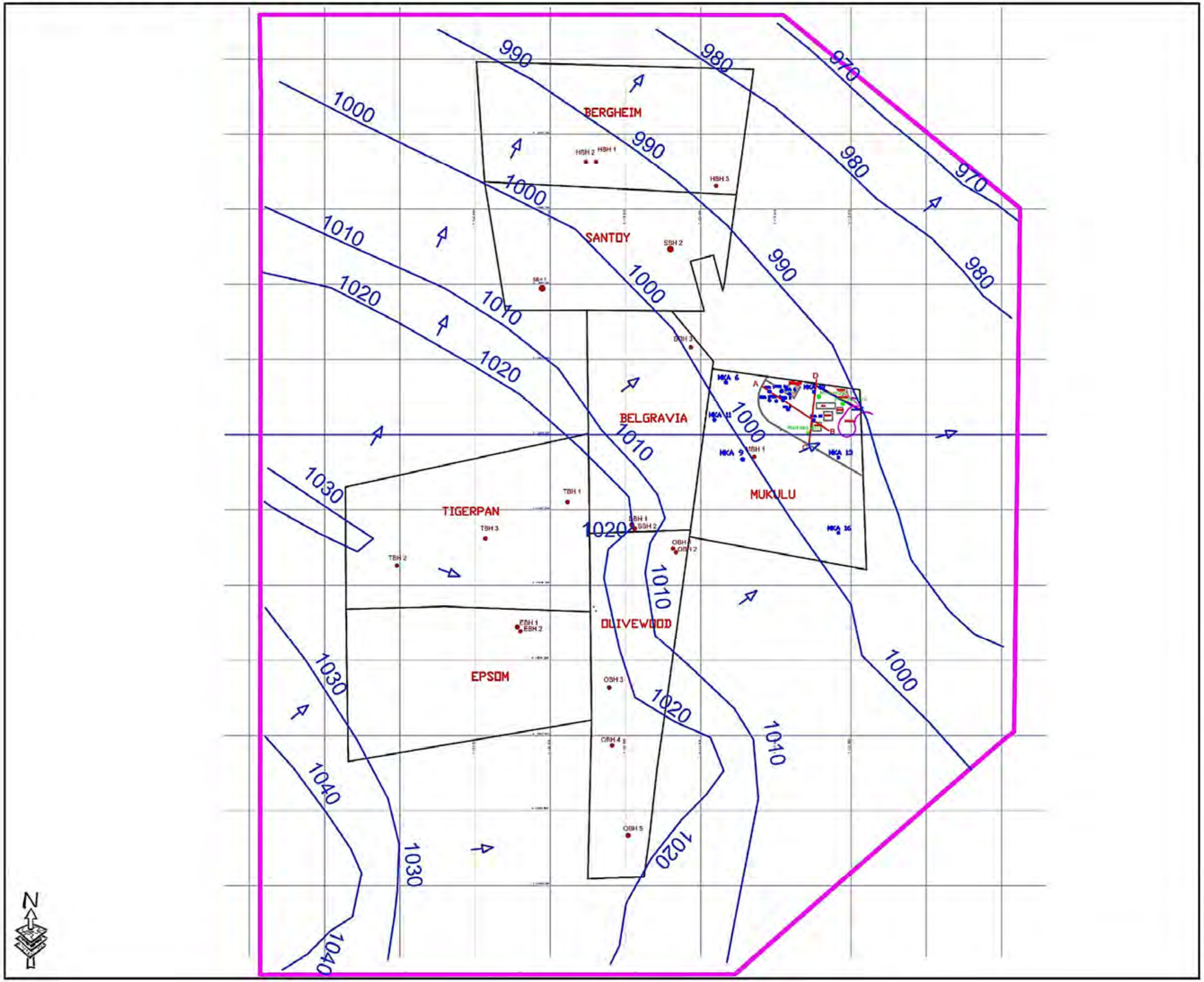
The groundwater flow gradient for the deeper aquifers is much steeper although the extent of the regional dewatering cone is not established yet. Figure 2.20 represents a simulation and interpolation of available data with the aid of the groundwater flow model.



[Figure is not to scale- refer to A3 map attached]

Figure 2.19 Groundwater Contours & Flow directions - Perched Aquifer

GROUNDWATER CONTOURS & FLOW DIRECTION - PERCHED AQUIFER



LEGEND

Model Boundary

BOREHOLES

Hydrocensus

Exploration

Monitoring

Section Lines

Perched Aquifer Water Level Contours

Flow Direction

FIGURE NO.:	
MAP NUMBER:	12-105-20120319-01
DRAWN BY:	L. DU PLESSIS GIS SPECIALIST (PGPT 0071)
REVIEWED BY:	H. BARNARD HYDROGEOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	28 MAY 2012
CLIENT:	EZENDALO LEGAL SOLUTIONS CC
PROJECT:	MUKULU PROJECT HYDROGEOLOGICAL INVESTIGATION
SCALE:	AS SEEN

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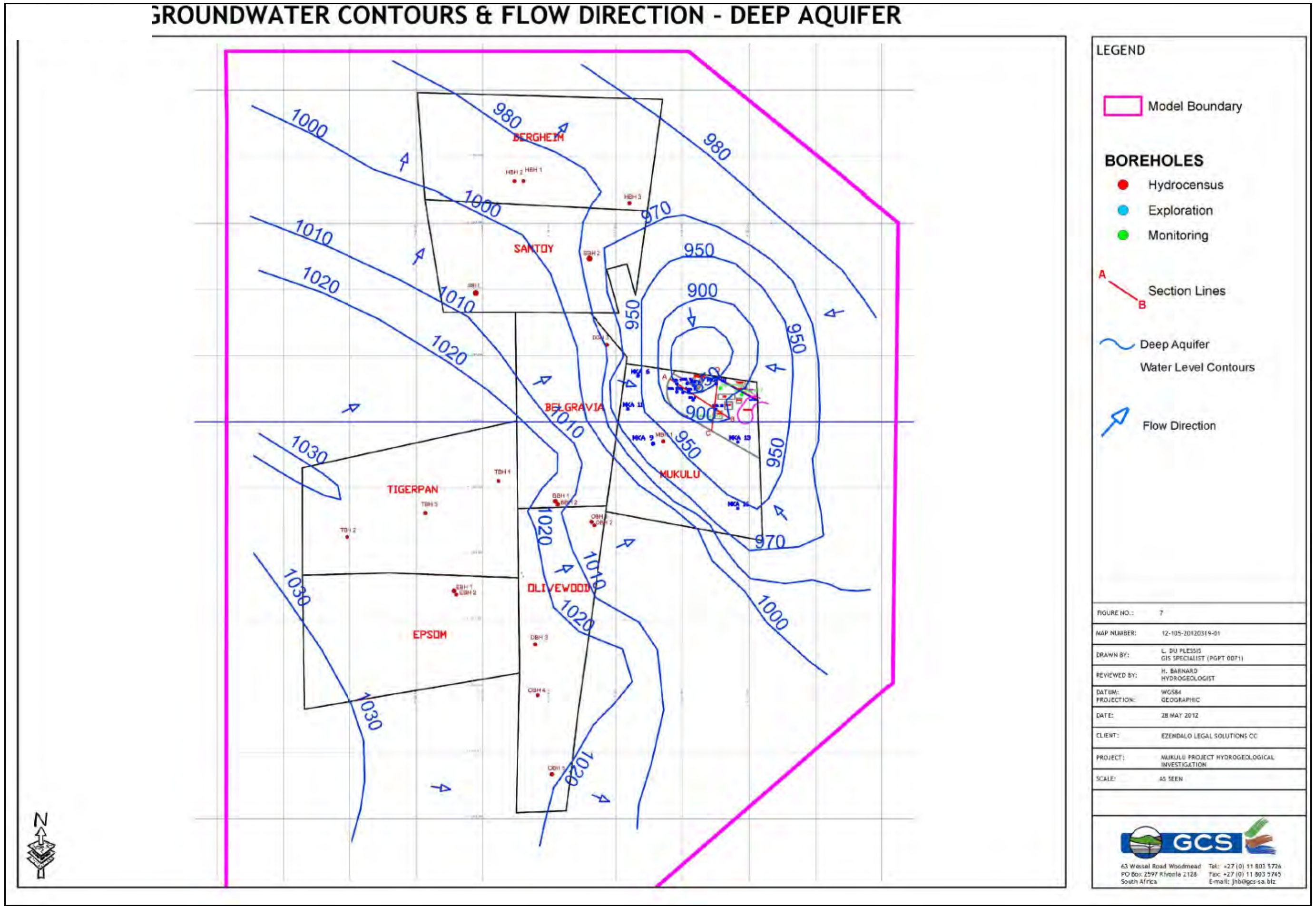
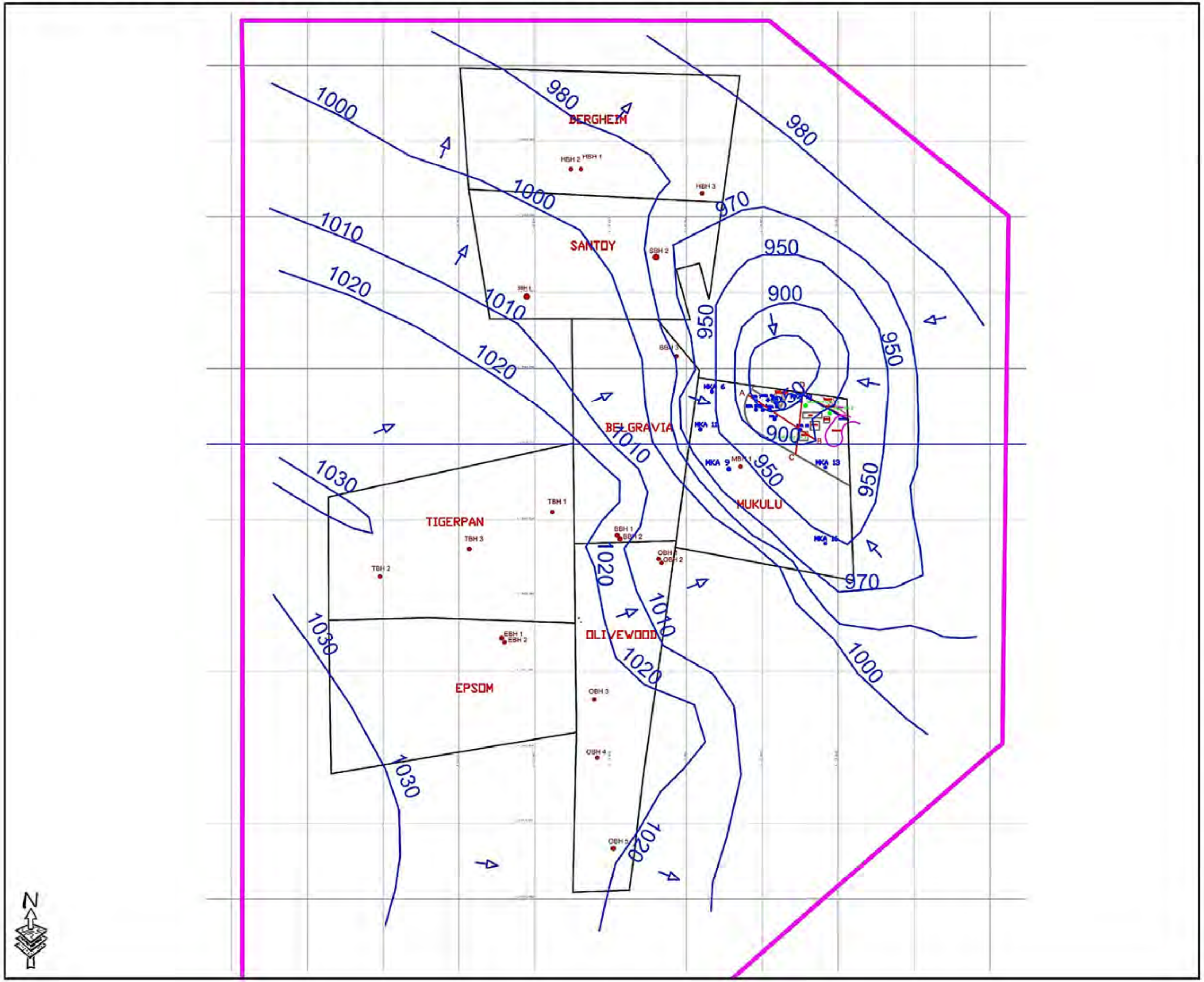


[Figure is not to scale- refer to A3 map attached]

Figure 2.20 Groundwater Contours and Flow Direction - Deep Aquifers

GROUNDWATER CONTOURS & FLOW DIRECTION - DEEP AQUIFER



LEGEND

Model Boundary

BOREHOLES

- Hydrocensus
- Exploration
- Monitoring

Section Lines

Deep Aquifer Water Level Contours

Flow Direction

FIGURE NO.:	
MAP NUMBER:	12-105-20120319-01
DRAWN BY:	L. DU PLESSIS GIS SPECIALIST (PGPT 0071)
REVIEWED BY:	H. BARNARD HYDROGEOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	28 MAY 2012
CLIENT:	EZENDALO LEGAL SOLUTIONS CC
PROJECT:	MUKULU PROJECT HYDROGEOLOGICAL INVESTIGATION
SCALE:	AS SEEN

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2.12 Air quality

No baseline air quality assessments were conducted relating to air quality for the proposed Mukulu Mine. Information contained in this section is taken from the EIA/EMP document compiled for the Assmang Black Rock Mine due to its proximity to the Mukulu Mine.

A desktop survey conducted during the scoping phase of the project, indicated that the impacts of settable dust within a 3km radius of the mine can be caused by surrounding mining operations and associated activities. Vehicle movement on the dirt roads may also contribute to the dust fallout concentrations.

Almost all mines have the capacity to produce dust, which could increase as a result of failure to control its natural proliferation, like rock dumps, or from increased physical activity, like crushing or transport. Dust is one of the most visible, invasive, irritating and potentially harmful forms of pollution. Dust has a high nuisance impact, lowering the quality of life in surrounding communities. Dust retards vegetation growth and reduces the palatability to animals

A dust fall out monitoring system has been in place at the Assmang Manganese Mines since 1999 and is run by Assmang personnel in conjunction with the CSIR. The monitoring sites were expanded towards the end of 1999 to include two baseline sites located in Kuruman and van Zylsrus. The dust monitoring conducted to date indicates that the dust levels are on average in the order of 2-3 $\mu g/m^3$ on the mine site. The dust levels in Kuruman and van Zylsrus are average approximately 0.5 to $\mu g/m^3$. However, the manganese levels in dust are higher at the on-mine monitoring sites. The maximum annual threshold for manganese in total suspended particulate samples (>SP) is $100 \mu g/m^3$, which is well above levels recorded anywhere, on the Assmang properties.

The principal sources of dust expected at the Mukulu operations are ore transfer points on conveyor belts, loading and handling activities associated with product piles and the crusher operation.

2.13 Sites of Historical and Cultural Importance

The information in this report was obtained from the Heritage Impact Assessment Report compiled by Archaetnos Culture & Cultural Resource Consultants following the site assessment undertaken during 7 to 11 May 2012. The report is attached under Appendix B-6 of this document.

The entire Mukulu Mine area was surveyed, with the exception of portion 0 of the farm Santoy 230 located in the north-eastern corner of the farm Santoy. This area is not indicated on a map, as the available cadastral information does not contain the farm portion boundaries.

The survey undertaken revealed eleven (11) sites of cultural heritage significance. The location of these sites is presented on the Google Earth image in Figure 2.21. These all date to the recent historical past or Historical Age.

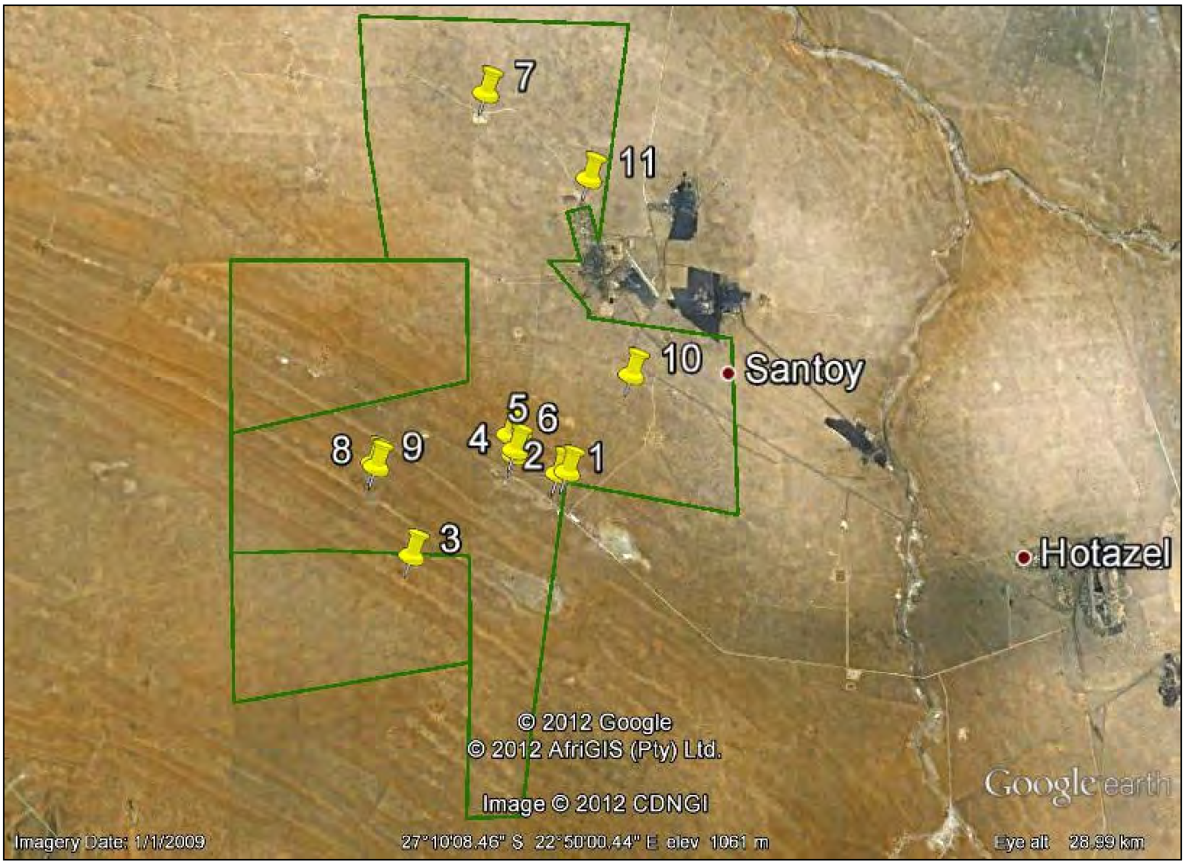


Figure 2.21 Locality map of the eleven cultural and historical sites identified (Google image)

2.13.1 Site 1: Original Farm House and Outbuildings on Olivewood 284

Site 1 (27°11.054'S, 22°49.286'E) comprises the original farm house and outbuildings on the farm Olivewood (Pers. Comm.: Koos Theart). A picture of one of the original farm buildings is shown in Photo 2.1. It is made from neatly cut limestone blocks and dates back to the 1920's.

The site is regarded as having a high cultural significance. The buildings together form a farm yard with a specific functionality and meaning. The house also has specific features such as the names of the builders chiseled out in the stone. It therefore is of a local significance and is given a rating of Grade IIIA:

- Local Grade IIIA should be included in the heritage register and not be mitigated (high significance).

A Grade IIA rating means that no adequate mitigation of impacts will be possible if disturbed and this area should therefore be maintained and preserved.

Photo 2.1 Buildings on Olivewood 284

The site is reasonably far from the proposed mining activities and there will therefore not be a direct impact the site.

2.13.2 Site 2: Graveyard on Olivewood 284

Site 2 (27°11.028'S; 22°49.434'E) comprises the grave yard associated with the first farmers of the farm Olivewood (Refer to Photo 2.2). It consists of three graves dating between 1922 and 1938. The graves have cement dressings and carved slate headstones. The surnames identified on the headstones are Heymans and Rossouw.

The graves identified are all older than 60 years and are therefore regarded as being heritage graves. The graves are of local significance and are therefore given a rating of Grade IIIB:

- Local Grade IIIB: Should be included in the heritage register and may be mitigated (high/ medium significance).

This means that mitigation is possible in the event of an impact occurring.

Photo 2.2 Graves identified at Site 2

2.13.3 Site 3: Graveyard on Epsom 285

Site 3 (27°12.257'S; 22°46.856'E) comprises a grave yard associated with the first farmers of the farm Epsom 285. Only one grave was visible, but Mr. Theart indicated that there definitely are two. The date on the visible grave is 1942 and the surname Van Niekerk. The grave has a carved slate border and headstone, but the latter has toppled over and is broken. It is however still legible.

Graves always are regarded as having a high cultural significance. The grave is older than 60 years and the second one unknown. They are therefore regarded as being heritage graves. The graves are of local significance and are therefore given a rating of Grade IIIB.

2.13.4 Site 4: Old School Building on Belgravia

Site 4 (27°10.786'S; 22°48.560'E) is an old school building which was apparently built during the 1920's. Mr. Theart indicated that he used to go to school here during the 1930's. It is on the farm Belgravia. The building is made from the same neatly cut limestone blocks as mentioned at earlier sites.

The site is regarded as having a medium cultural significance. It is not very unique to the area, but does tell a story about this area. It therefore is of a local significance and is given a rating of Grade IIIB:

- Local Grade IIIB: Should be included in the heritage register and may be mitigated (high/ medium significance).

It may therefore be mitigated. The site is reasonably far from the mining activities.

2.13.5 Site 5: Farmyard on Belgravia 264

Site 5 (27°10.705'S; 22°48.568'E) is the original farm yard (house and outbuildings) of the farm Belgravia 264. It dates to the 1920's and is similar to other limestone buildings mentioned above.

The site is regarded as having a medium cultural significance. It is not very unique to the area, but does tell a story about this area. It therefore is of a local significance and is given a rating of Grade IIIB (Should be included in the heritage register and may be mitigated (high/ medium significance)).

It may therefore be mitigated. The site is reasonably far from the mining activities.

2.13.6 Site 6: Greyard on Belgravia 264

Site 27°10.485'S; 22°48.471'E) is a grave yard associated with the first farmers of the farm Belgravia 264 (Refer to Photo 2.5). It contains three graves. The dates on the graves vary between 1926 and 1937 and the only surname identified is Pretorius. The graves either have cement or slate dressings and slate or granite headstones.

Photo 2.3 Site 6: Graveyard on Belgravia 264

2.13.7 Site 7: Limestone house on Bergheim 229

Site 7 (27°05.450'S; 22°48.085'E) is a limestone house similar to others identified within the project area. It was found on the farm Bergheim and may be the original farm house. It dates to the 1920's.

The site is regarded as having a medium cultural significance. It is not very unique to the area, but does tell a story about this area. It therefore is of a local significance and is given a rating of Grade IIIB (Should be included in the heritage register and may be mitigated (high/ medium significance)).

It may therefore be mitigated. The site is reasonably far from the mining activities.

2.13.8 Site 8: Limestone House and Wagon House of Tigerpan 266

Site 8 (27°10.949'S; 22°46.269'E) is another limestone house and a wagon house similar to others mentioned above. It was found on the farm Tigerpan 266 and probably dates to the 1920's.

The site is regarded as having a medium cultural significance. It is not very unique to the area, but does tell a story about this area. It therefore is of a local significance and is given a rating of Grade IIIB (Should be included in the heritage register and may be mitigated (high/ medium significance)).

It may therefore be mitigated. The site is reasonably far from the mining activities and there will therefore not be a direct impact.

2.13.9 Site 9: Outbuildings on Tigerpan 266

Site 9 (27°10.900'S; 22°46.230'E) comprises outbuildings at a farm dam close to the Tigerpan house. It also is limestone buildings similar to others mentioned above. It was found on the farm Tiger Pan and probably dates to the 1920's.

The site is regarded as having a low cultural significance. It is not very unique to the area, but does tell a story about this area. These ones however are not in such a good condition and have been changed. It therefore is of a general significance and is given a rating of Grade C (General protection C (IV C): Phase 1 is seen as sufficient recording and it may be demolished (low significance)).

The site is reasonably far from the mining activities and there will therefore not be a direct impact. It should therefore be left as it is. It may however be demolished if needed.

2.13.10 Site 10: Shooting Range on Mukulu 265

This is an old shooting range on the farm Mukulu. It most likely is younger than 60 years. The site is regarded as having a low cultural significance. It is not very unique. It therefore is of a general significance and is given a rating of Grade C (General protection C (IV C): Phase 1 is seen as sufficient recording and it may be demolished (low significance)).

2.13.11 Site 11: Farmyard on Santoy 230

This is yet another farm yard with limestone building similar to others mentioned in this report. It was found on the Santoy and dates to the 1920's. The site is regarded as having a medium cultural significance. It is not very unique to the area, but does tell a story about this area. It therefore is of a local significance and is given a rating of Grade IIIB Should be included in the heritage register and may be mitigated (high/ medium significance)). It may therefore be mitigated.

The site is reasonably close to the mining activities and there will be a definite secondary impact.

2.14 Noise

No baseline noise studies have been carried out to determine the contribution of the mine to the local noise levels. The surrounding land is however largely rural in nature and base noise levels can be expected to be low. Noise levels at the mine sites are typical of small remote mine sites. The areas surrounding the mine sites are rural in character and contribute low levels of background noise.

Hoisting, vehicular traffic, conveying, ore transport, amongst others, regardless of where the noise originates from, noise pollution becomes more acute and more important depending on the proximity of neighbouring residences. The impacts of noise levels can be both physical and physiological at the high end of the spectrum but more commonly impact on communication or create psychological effects at the lower end of the spectrum. The negative community response even to relatively low noise levels is one of the most common environmental considerations.

The repetitive operation of machinery also creates a range of noise levels. Although of low intensity these have an impact due to long periods of operation e.g., crushing plant and mills. These operations will be effectively screened to reduce or deflect noise where possible. Vehicle engine or loading noise and even reverse warning alarms on trucks and loaders can impact communities near a mine. Machinery such as compressors, generators, metal workshop tools such as angle grinders, pneumatic drills and jackhammers create high noise levels that are difficult to screen.

The principle sources of noise in the mining surface environment include ore transport by conveyor, vehicle movement of ore on the stack floors, crushing and screening of ore and road noise associated with service and labour transport and rail noise from ore trains.

2.15 Traffic

No baseline traffic assessments were conducted for this process. Main Street 778 will make use of the existing road network (Refer to Figure 1.2) for the duration of the construction period; whereafter product will be transported via railway system to the market. Should the option to use the Transnet rail system not be viable, the potential impact on the road conditions due to transportation of ore via road networks will be significant. In such an event, agreements should be in place with the relative local municipalities (Roads and Transport) to ensure the upkeep of the roads, and the impact on the surrounding landowners should also be assessed by way of a Traffic Impact Assessment.

It is anticipated that the proposed mine will lead to an impact on the roads and transport facilities within the proximity of the site. It is expected that Main Street will contribute towards the upkeep of the roads on which they operate.

2.16 Social Conditions

The Northern Cape Province is the largest province in South Africa with a land area the size of 361 830 km^2. The province has a population density of 2 persons per every km^2. Prominent languages include Afrikaans, English, Nama, SeTswana and Xhosa (www.northerncape.org.za). The Province is divided into five (5) District Municipalities (Namakwa, Pixley ka Seme, Siyanda, Frances Baard and John Taolo Gaetswe DM). These are again subdivided into four (4) Local Municipalities. Major Towns include Calvinia, Colesberg, Kuruman, Springbok and Upington.

The area of jurisdiction of John Taolo DM is surrounded by Dr Ruth Segomotsi Mompati DM to the north-east, Frances Baard DM to the south, Siyanda DM to the south-west and the republic of Botswana in the north-west (http://en.wikipedia.org). The John Taolo DM is divided into the following LM:

- Joe Morolong (formerly Moshaweng LM);
- Ga-Segonuana LM;
- Gamagara LM; and
- Kalahari LM.

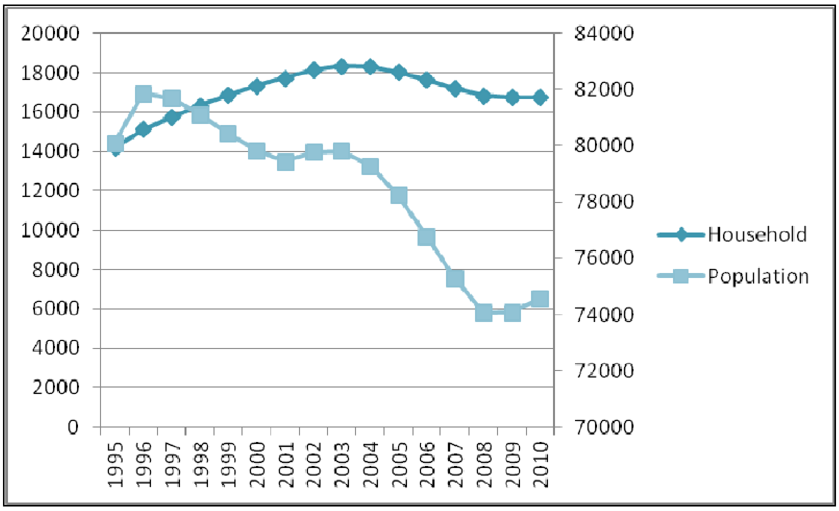
Joe Morolong Local Municipality consists of the following main towns:

- Blackrock;
- Hotazel;
- Kuruman;
- Kalahari; and
- Van Zylsrus.

2.16.1 Demographic profile

2.16.1.1 Population and household profile

According to Figure 2.22, the population size (persons) for the Joe Morolong LM decreased dramatically over the 1996 to 2008 time period, only slightly increasing again in 2009 and 2010. Households have, however, steadily increased over the 1995 to 2004 time period, slightly levelling off from 2005 onwards.

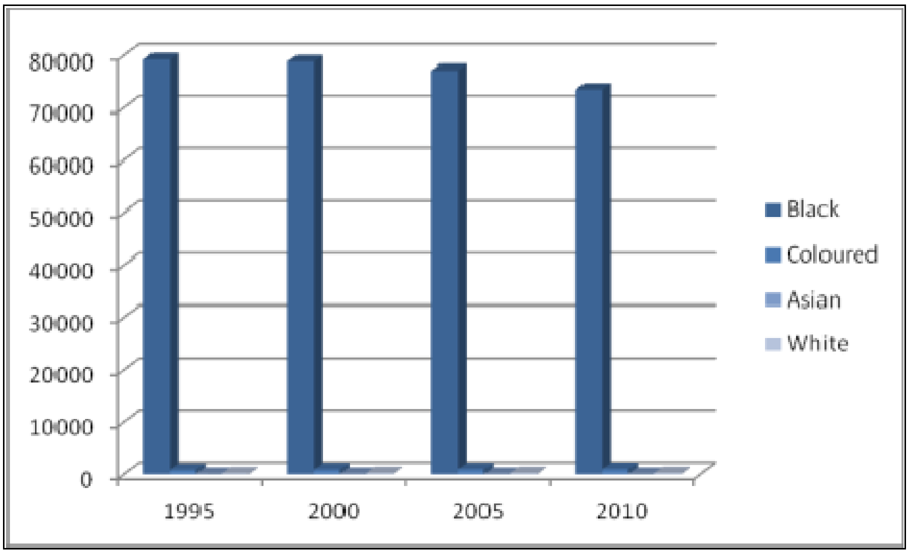


Source: Quantec Research (Pty) Ltd

Figure 2.22 Population and household size (1995 - 2010)

2.16.1.2 Population group

Figure 2.23 (2010) indicates that the Joe Morolong LM population are composed of mostly Black African persons (98.51%) followed by 1.21% Coloured persons.



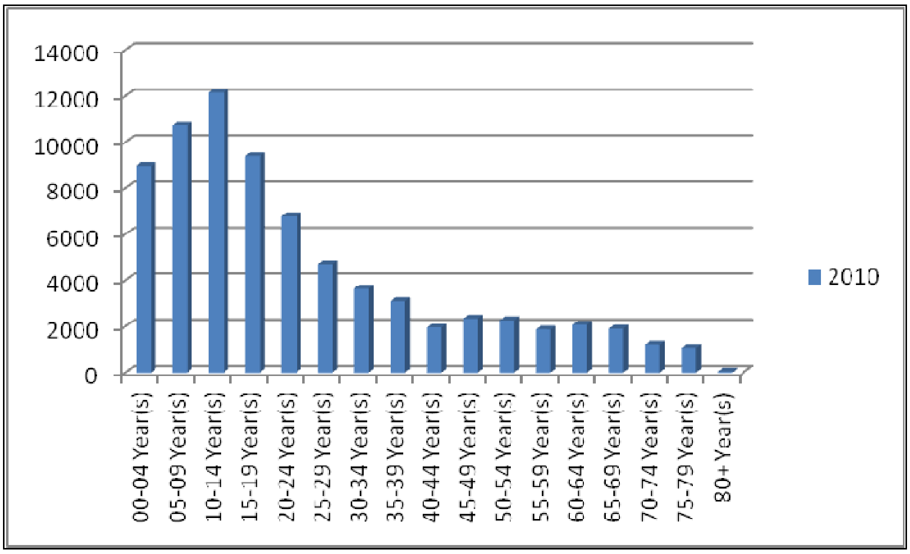
Source: Quantec Research (Pty) Ltd

Figure 2.23 Population group (1995 - 2010)

2.16.1.3 Age

It is important to assess the age distribution of persons in order to determine both the current and future needs of an area. Age is an important indicator as it relates to education, skills and dependency. A young population may require an improved educational system, whereas an older society may need an accented focus on healthcare. The Joe Morolong LM population has a large adolescent population, steadily levelling off from 19 years of age (Figure 2.24). With 42.92% of the population being younger than 15 years of age, indicating that they do not form part of the Economically Active Population (EAP) of the area.

A relatively small portion of the Joe Morolong LM population falls among the 35 to 39 year age band. These persons normally form part of the economically active group, and since they have more work experience, usually fall within the higher skilled and higher salary bracket. One can clearly note that the population starts decreasing from the age of 20 years, leaving fewer economically active individuals.

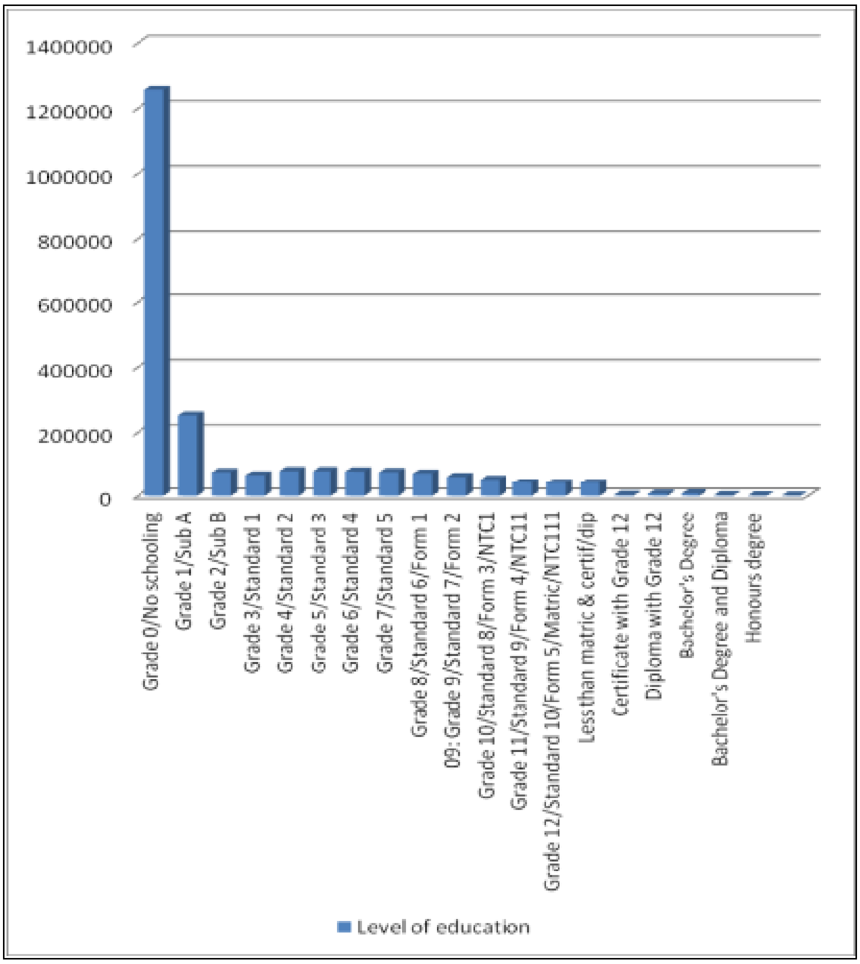


Source: Quantec Research (Pty) Ltd

Figure 2.24 Age (2010)

2.16.1.4 Education

The largest percentage (54.71%) of the Joe Morolong LM population has not obtained any form of schooling (Figure 2.25). Only 0.78% of the population achieved an academic level higher than Grade 12.



Source: Quantec Research (Pty) Ltd

Figure 2.25 Education level (1995 – 2010)

2.16.2 Economic profile

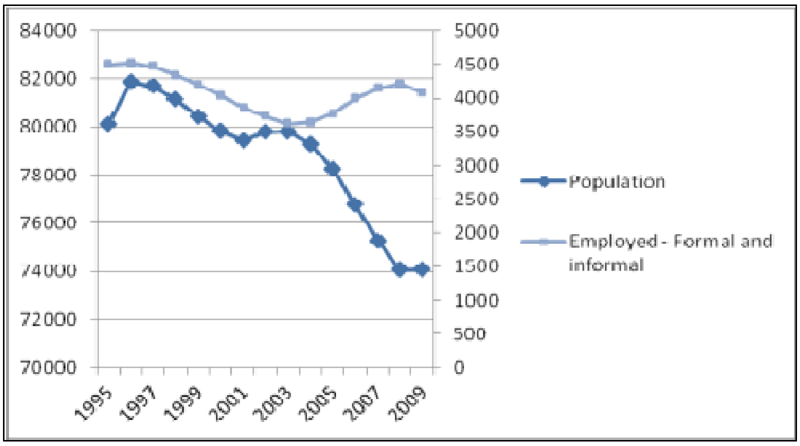
This section provides a delineation of the study area and a brief economic status quo pertaining to Employment and labour profile.

2.16.2.1 Employment and labour profile

The employment status of the population has a variety of important implications. Economically active and employed persons can contribute to the overall welfare of a specific community by paying their taxes, looking after the youth and aged and by stimulating the economy. However, should a community have a large number of economically inactive and / or unemployed persons, the burden on the economically active people of that community are amplified.

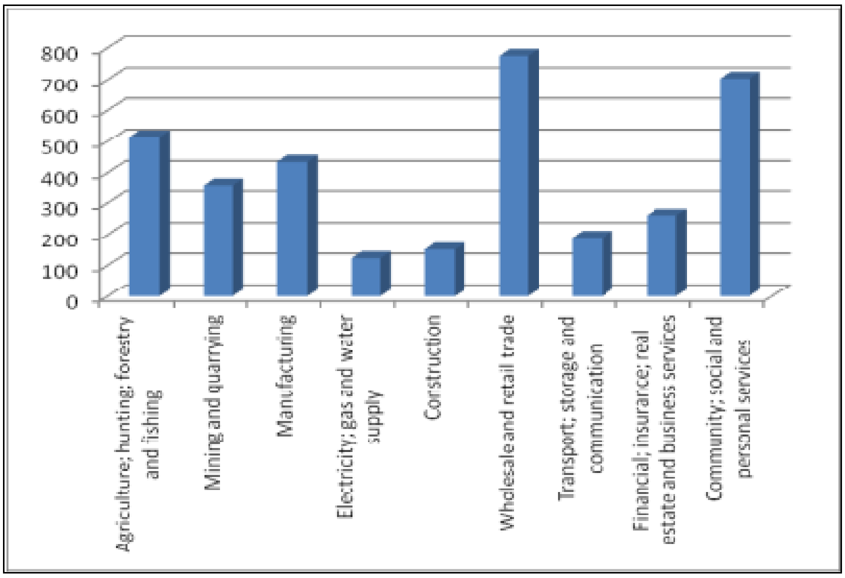
Figure 2.26 illustrates that the Joe Morolong LM employment rate decreased dramatically after 2003, reaching the lowest level in 2007. This coupled with an increase in population indicated that the Joe Morolong LM require an immediate boost in the economy that will lead to mass job creation and business opportunities.

According to the Joe Morolong LM IDP (2011/2012) the municipality is "faced with severe economic challenges". The area is poverty-stricken and faces harsh realities of chronic unemployment and [has] a huge dependency on government grants".



Source: Quantec Research (Pty) Ltd

Figure 2.26 Economic status (1995 – 2009)



Source: Quantec Research (Pty) Ltd

Figure 2.27 Industry (2007 Community Survey)

Figure 2.27 indicates that the wholesale and retail industry is currently creating the most employment opportunities within the Joe Morolong LM. The mining and quarrying industry only represents the fifth largest employment sector within the LM.

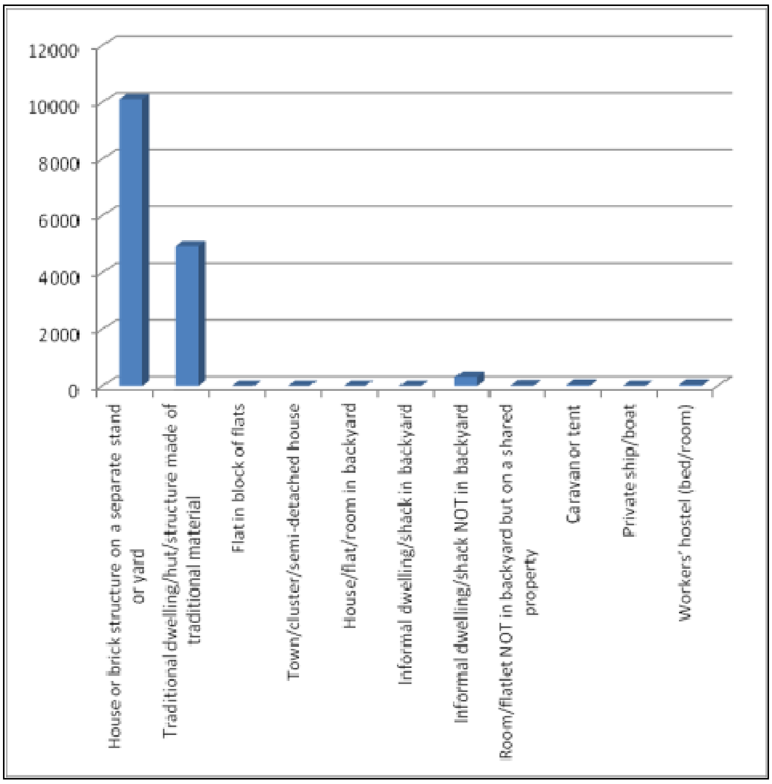
2.16.3 Services and infrastructure profile

Social service delivery centres on the provision of health, education and community development facilities and services. The concept of service delivery also comprises various elements such as affordability, quality, efficiency and access.

This indicator therefore examines the level of service provision in the study area. Services assessed include sanitation, water, housing and electrification. There are three priority services (water, sanitation and electricity) for the promotion of health, convenience and quality of life.

2.16.3.1 Housing

According to Figure 2.28 the Joe Morolong LM has been steadily formalising informal settlements within its municipal area. Persons residing within informal settlements have decreased by 18% between 2001 and 2007.

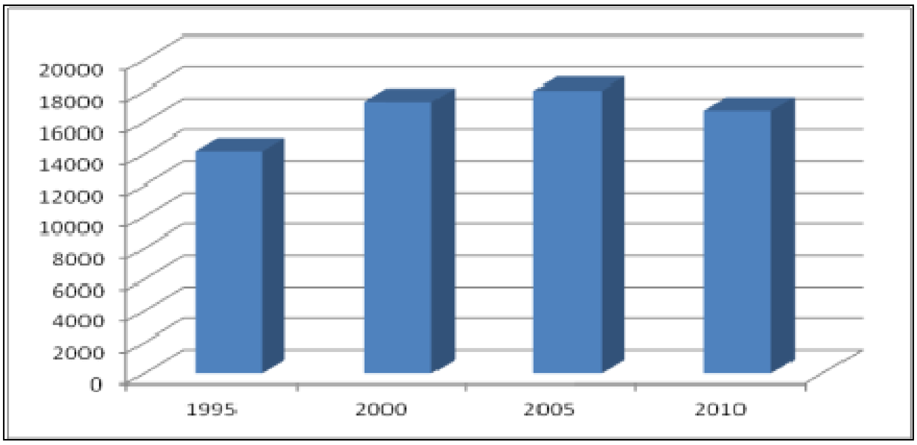


Source: Quantec Research (Pty) Ltd

Figure 2.28 Type of dwelling (2007 Community Survey)

2.16.3.2 Energy use

Figure 2.29 indicates that the use of electricity for lighting has increased between 1995 and 2005, with a gradual decrease of 19.6% from 2010, which could be attributed to the heightened public awareness surrounding sustainable energy use.

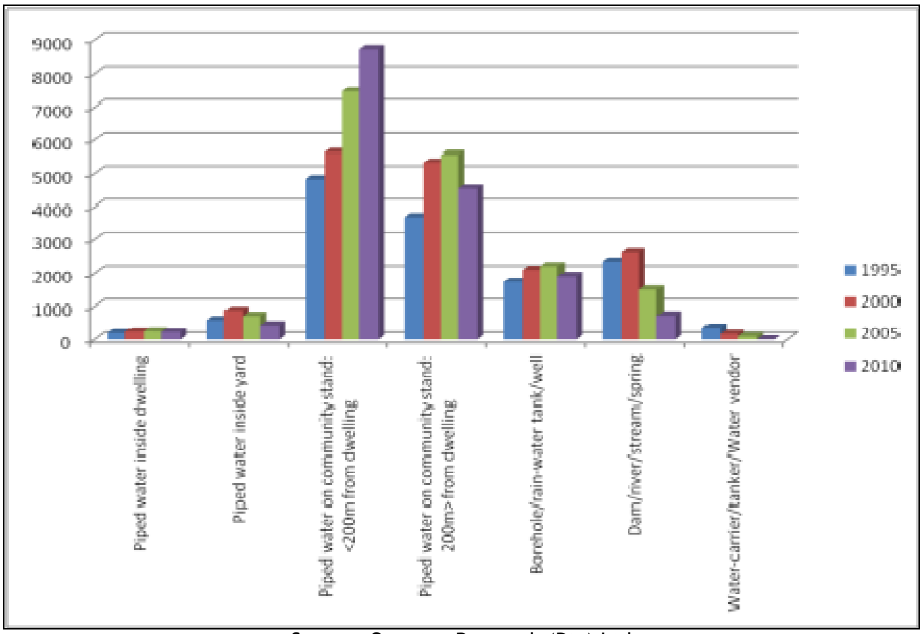


Source: Quantec Research (Pty) Ltd

Figure 2.29 Type of energy (2007 Community Survey)

2.16.3.3 Water and sanitation

Figure 2.30 illustrates that Joe Morolong LM has incrementally increased the level of water supply to households with the biggest improvement in water sources closer than 200m from the dwelling. Households with access to piped water inside their dwellings have remained low.



Source: Quantec Research (Pty) Ltd

Figure 2.30 Type of water source (2007 Community Survey)

According to the Department of Water Affairs (www.dwaf.gov.za), the Joe Morolong LM has a 20% backlog in providing households with water supply (below RDP level). Table 2.16 indicates the progress the municipality has made from 1994 to 2011.

Table 2.16: Water Supply Backlog - Households (Access below RDP)

TOTAL WATER BELOW RDP	APR 1994	OCT 2001	APR 2009	APR 2011	% BACKLOG
15 543	15 543	13 545	6 998	4 934	20.44

Source: www.dwaf.gov.za

Table 2.17 does, however, indicate that a large amount of money has already been allocated to the municipality. A total of 18 projects have been launched, with the total number of households to benefit from these projects being 4 645 (www.dwaf.gov.za).

Table 2.17: Municipal Infrastructure Grant Expenditure

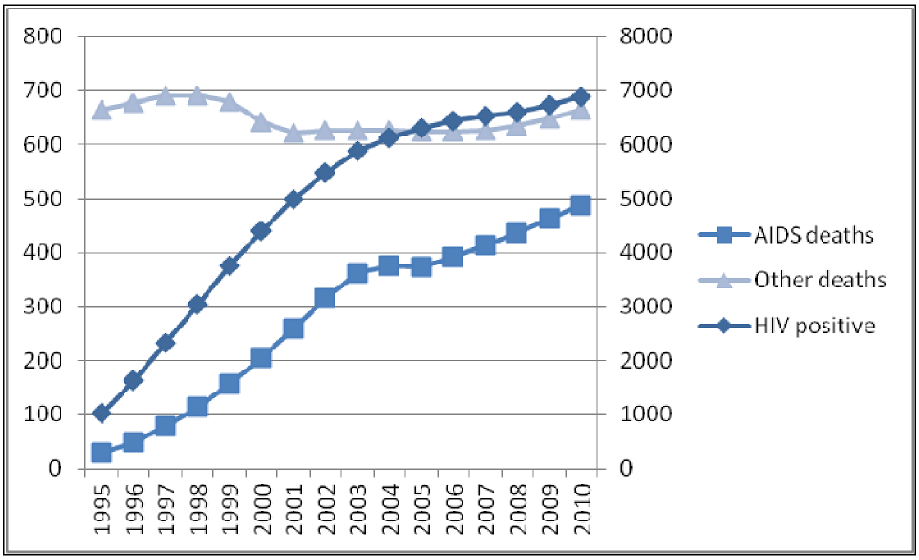
Projects	Total actual expenditure during financial year (Rand)			Number of households to benefit
	2006/07	2007/08	2008/09	
18	13,260,937.29	2,845,105.69	1,621,310.99	4 645

Source: www.dwaf.gov.za

2.16.3.4 Healthcare

HIV/AIDS in South Africa has increased rapidly over the past decade. The social and economic consequences of the disease are far reaching and affect every facet of life in South Africa. Despite South Africa creating a progressive and far-sighted policy and legislative environment for dealing with HIV/AIDS, the prevalence of HIV/AIDS continues to increase. This indicates that policies and laws have not been adequately implemented and have not impacted significantly on the ground.

Figure 2.31 shows that the number of HIV positive persons living within the Joe Morolong LM in 2010 has increased by 7.50% since 1995. The number of HIV related deaths has however dramatically increased. This indicates that HIV/AIDS is a real concern within the LM.



Source: Quantec Research (Pty) Ltd

Figure 2.31 HIV/AIDS status (1995 - 2010)

3 PROJECT DESCRIPTION

This chapter describes the proposed surface infrastructure, mining infrastructure, mining method, etc., thereby fulfilling the requirements as per Regulation 50 (a) of the MPRDA Regulation R527 and the EMP Template.

REGULATION 50 (a):

- *(Section 1 – 2): The proposed mining operation*
  - *(Section 1 – 2.1): The mineral to be mined;*
  - *(Section 1 – 2.2): The mining method to be employed at the level of opencast, underground, stoping, stooping, total extraction, bord and pillar, block caving, shrinking, dredging, pumping, monitoring, etc. and provide a concise description of the intended magnitude thereof, in terms of volumes, depth and aerial extent;*
  - *(Section 1 – 2.3): List of the main mining actions, activities, or processes, such as, but not limited to, access roads, shafts, pits, workshops and stores, processing plant, residue deposition sites, topsoil storage sites, stockpiles, waste dumps, access roads dams, and any other basic mine design features;*
  - *(Section 1 - 2.4): Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes as required to calculate the financial provision in accordance with the Department's published guideline. (Reg. 51 (b) (v));*
  - *(Section 1 - 2.5):Listed activities (in terms of the NEMA EIA regulations) which will be occurring within the proposed project (Refer to section 1.5.3);*
  - *(Section 1 - 2.6): Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the implementation of these actions, activities or processes and infrastructure; and*
  - *(Section 1 – 2.7): Confirmation if any other relevant information is attached as appendices.*

The information contained in this chapter has been obtained from the Mining Works Programme (MWP) submitted to DMR in November 2011, the Integrated Development Plan for the district municipality, as well as relevant publications regarding the available services in the area.

3.1 Existing Infrastructure

The properties within the Mukulu Mine MRA are used for extensive for cattle, sheep, goat and game farming.

Although there is evidence of historic mining activities on the farm Mukulu 265 in the form of excavations less than 1km north of the R380 road, no mining infrastructure exists on Mukulu 265 or within the rest of the MRA.

Existing infrastructure within the Mukulu Mine MRA include gravel roads on the farms, as well as the small residential village located on the farm Mukulu 265, which was originally developed by Assmang to house workers from the Black Rock Mine. However, during an informal meeting between Assmang Black Rock Mine representatives and Mr. Bava Reddy from Atlasa on 10 May 2012, Bava Reddy was informed that the village is currently not occupied.

3.2 Overview of Proposed Operations

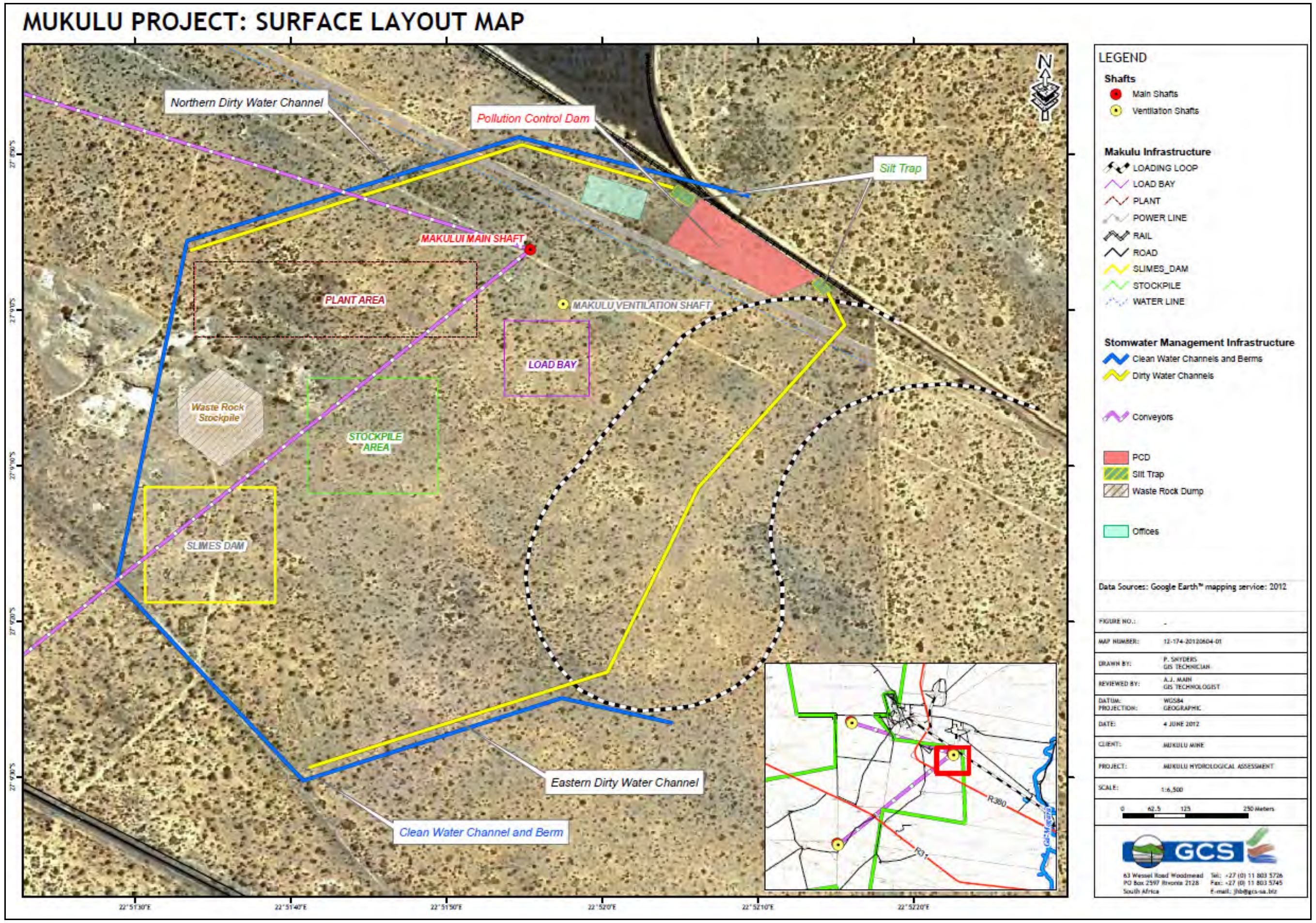
The proposed Mukulu Mine has a projected life of mine (LoM) of 29 years. The LoM comprise of initial exploitation on Mukulu starting in 2016, thereafter the shaft on Olivewood 284 will be phased in by 2025, followed by the shaft on Belgravia 264 in 2038. The surface infrastructure which is proposed for the Mukulu Mine Mining operation will be located on Mukulu 265. Two other shafts, together with the associated headgear will be located on Olivewood 284 and Belgravia 264. The planned infrastructure is presented in Figure 3.1 and described briefly Table 3.3. A detailed description of the proposed project is provided in the following section of this chapter.

Table 3.1 Mukulu Mine Production Forecast

ACTIVITY	REQUIRED INFRASTRUCTURE	REQUIRED SERVICES
Underground extraction of ore from mineral resource blocks located	• Twin vertical (access and ventilation) shafts to be located on: Mukulu 265,, Olivewood 284 and Belgravia 264; • Two settling dams south of the main shaft on Mukulu; • Waste Rock Dumps (at each shaft); and • Explosives magazine;	Electricity and water supply
Crushing of ore by the underground primary crusher	• Primary crusher (underground); • Rock breaker with a grizzly- to prevent blockages and to bypass fine ore; • Underground Ore Silo- with a volume of 2 450m^3 and the capacity to store 5 439 tonnes of ore; and • Two (2) fresh water dams, with a combined capacity in excess of 1.5 million liters (1 500m^3).	Electricity and water supply

ACTIVITY	REQUIRED INFRASTRUCTURE	REQUIRED SERVICES
Conveying crushed ore from underground to the Run of Mine (ROM) Stockpile	• Conveyors between main shafts on Mukulu 265, Olivewood 284 and Belgravia 264; and • ROM Stockpile area adjacent to the beneficiation plant.	Electricity and water supply
Crushing and screening or ore at the beneficiation plant to be located on Mukulu 265	• Secondary Crusher (on surface); • Tertiary Crusher (on surface); • Front End Loader (FEL) at ROM ore stockpile; • Screen Feed bins at the Secondary and Tertiary Crusher; • Product Stockpile; • Paste Disposal Facility (PDF) with Return Water Dam (RWD)	Electricity and water supply
Temporary Storage of ore and transportation for the local market and export.	• Railway loop and loading station (linked to the existing private railway line or to the Transnet railway line); and • Weighbridges located in the vicinity of the railway loop on Mukulu. Weighbridges will be located close to the access road, in the event that road transport is considered as an option for the transport of ore.	
General	• Internal haul roads; • Access road to the mine; • Powerlines (Eskom) and substation near the main plant; • Water pipelines for bulk potable water supply (planned from the Vaal Gamagara Water Scheme managed by Sedibeng Water); • Potable water tanks; • Diesel storage areas; • Waste Storage/handling areas; • Workshops; • Salvage Yard close to the workshop area on Mukulu 265; • Parking areas • Sewage Package Plant.	

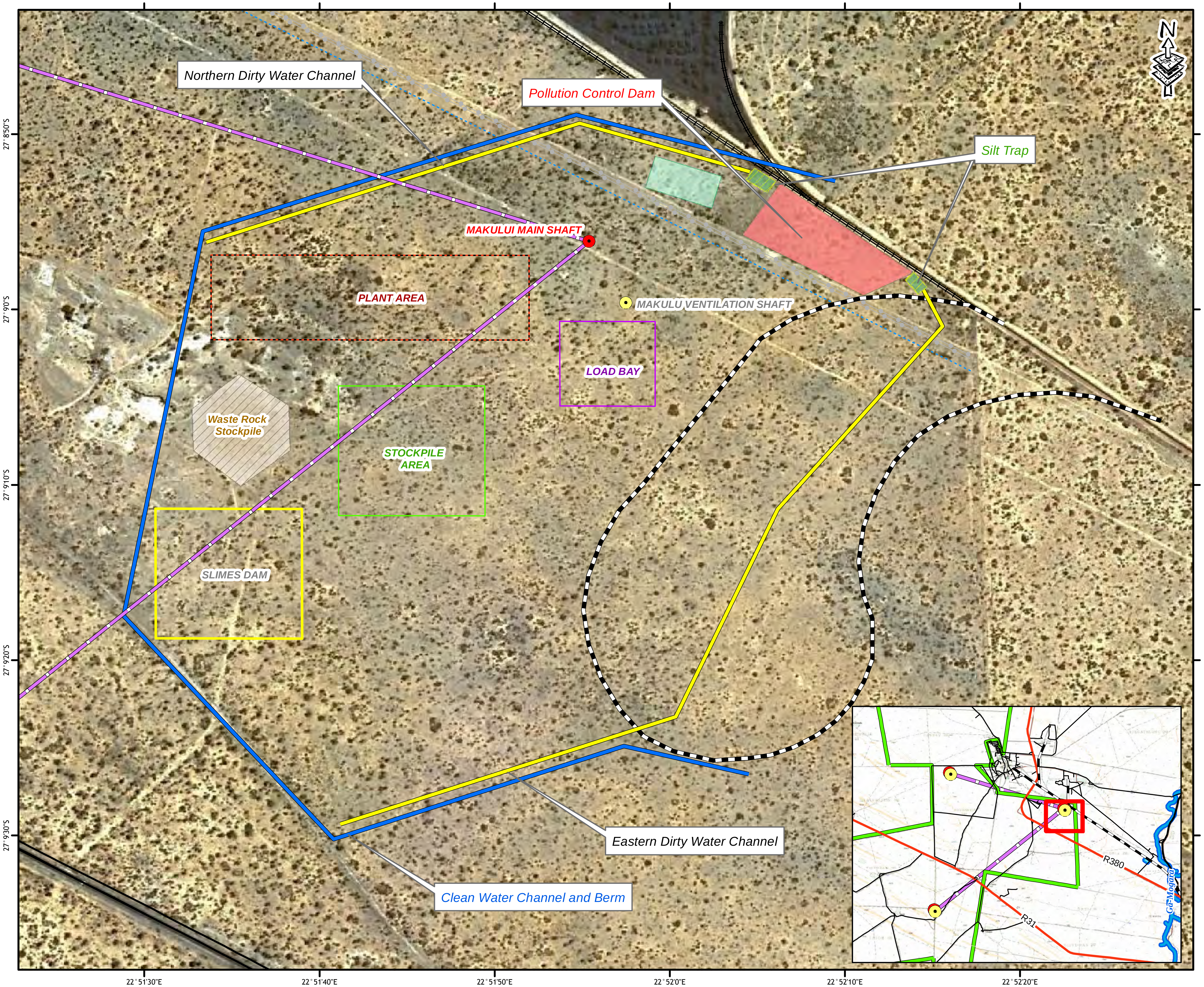
The surface infrastructure on Mukulu will be located above the orebody to be mined. A Geotechnical Investigation will be required to ensure that the area will be sufficiently stable for the location of the required infrastructure once the underground works is established.



[Figure not to scale- refer to A3 figure attached]

Figure 3.1 Mukulu Mine General Surface Layout

MUKULU PROJECT: SURFACE LAYOUT MAP



LEGEND

Shafts

- Main Shafts
- Ventilation Shafts

Makulu Infrastructure

- LOADING LOOP
- LOAD BAY
- PLANT
- POWER LINE
- RAIL
- ROAD
- SLIMES_DAM
- STOCKPILE
- WATER LINE

Stomwater Management Infrastructure

- Clean Water Channels and Berms
- Dirty Water Channels
- Conveyors
- PCD
- Silt Trap
- Waste Rock Dump
- Offices

Data Sources: Google Earth™ mapping service: 2012

FIGURE NO.:	-
MAP NUMBER:	12-174-20120604-01
DRAWN BY:	P. SNYDERS GIS TECHNICIAN
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	4 JUNE 2012
CLIENT:	MUKULU MINE
PROJECT:	MUKULU HYDROLOGICAL ASSESSMENT
SCALE:	1:6,500

0 62.5 125 250 Meters

GCS

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3.3 Mining Process

3.3.1 Mining Method

The bord and pillar mining method, which is commonly used in underground mines in the Kalahari Manganese Field (KMF), will be utilised. This mining method recovers the ore from open stopes and leaves pillars to support the roof. In order to recover the maximum amount of ore, the smallest possible pillars are left for support without compromising the stability of the roof.

The estimation of bord and pillar sizes was based on the practices currently in use at neighbouring mines. Mukulu Mine will be at depths in excess of 440m below surface and therefore a pattern of 8m square pillars and 7m bords will be adopted.

The various fault blocks are accessed by the main twin development. Once within a block the stoping sections will be delineated by means of twin block development to define a stope consisting of nine (9) bords as presented in Figure 3.2.

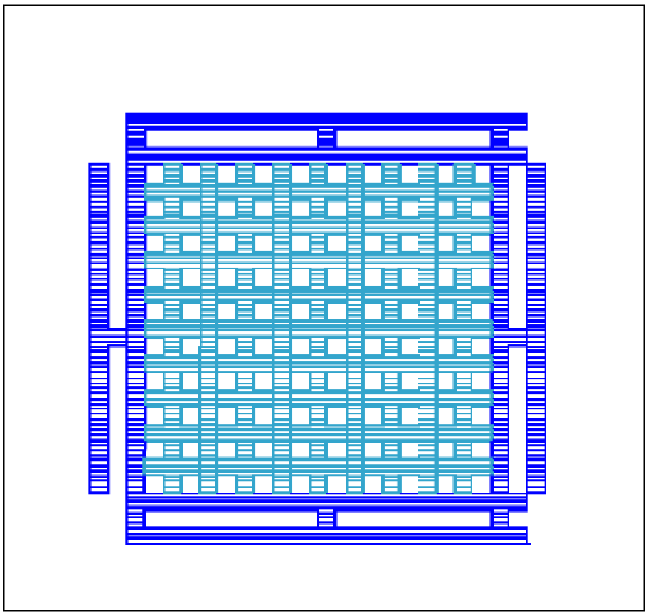


Figure 3.2 Stoping pattern for 8m pillars

The extraction ratio calculated for the stoping sections and their associated block development is: 8m pillars – 68.2%

3.3.2 Mineral Resource Blocks

The three mineral resources blocks identified are shaded in grey on Figure 3.3.

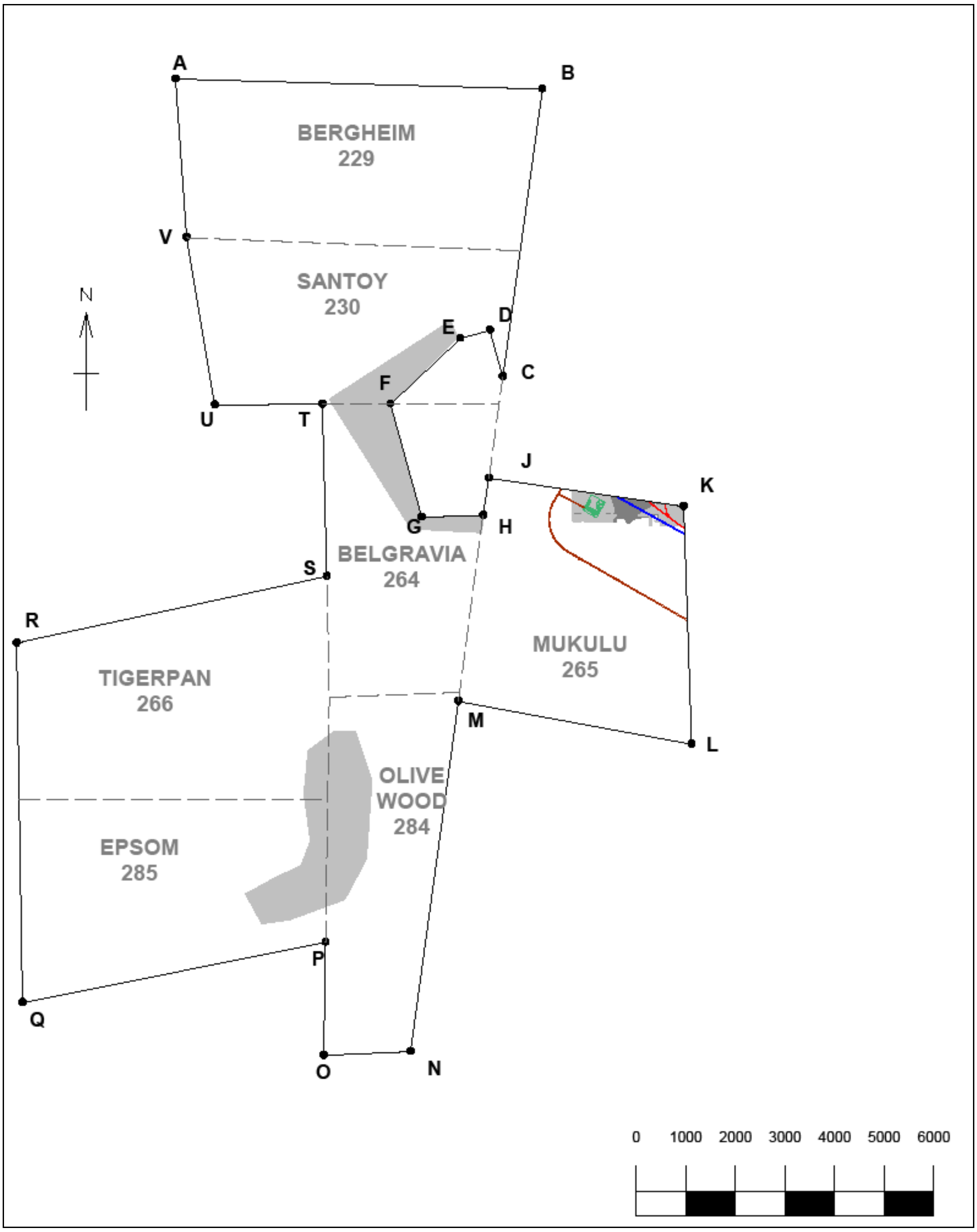


Figure 3.3 Mukulu Mine Mineral Resource Blocks (MWP, 2011)

3.3.3 Mine product

Blasting of manganese ore typically creates a range of ore sizes. The precise cut points used for products would be determined by customer requirements but these can be broadly divided into three broad size categories:

- Lumpy: between -75mm to +6mm;
- Fines: between -6mm to +1.5mm; and
- Tailings: less than 1.5mm.

3.3.4 Mine Shafts

Each of the three (3) ore bodies will be accessed by a twin vertical shaft system from surface. Each system will consist of a main shaft for men, materials and rock hoisting and a ventilation shaft equipped with an emergency hoist. The main shaft with be used as an intake airway while the ventilation shaft will be used as a return airway.

Shafts to access the three ore bodies will be developed on Mukulu 265, Olivewood 284 and Belgravia 264. These are discussed in more details in this section.

3.3.4.1 Mukulu

Main Shaft

The main shaft on Mukulu 265 (S 27° 08' 54.373", E 22° 51' 57.201"), shown on Figure 3.1, will be 630m deep and comprise of three (3) stations. The UMO station will be at 508m below collar, the LMO station will be at 536m below collar and the Loading Level station will be at 574m below collar. This shaft will be circular and 11m in diameter.

The main shaft will be sunk according to conventional blind sink methods, with off shaft station development being constructed as concurrent activities while sinking progresses.

The shaft bottom will be connected to a dam and a vehicle ramp (inclined at 9 degrees) connecting shaft bottom with the loading level (Refer to Figure 3.4).

The loading level, which will be situated 38m above shaft bottom, is where the mined ore will be loaded into the skips for hoisting to surface. One (1) vertical ore storage silo will connect the LMO production level to the loading level. Ore will be drawn from the bottom of this 8m diameter silo through a chute and onto a feed conveyor that will discharge rock through a measuring flask system and into the skips. The ore silo, with a volume of 2 450m^3 will be able to store 5 439 tonnes of ore. A raise bored travelling way (58m long) connects the bottom of the silo to the crusher chamber on the LMO level (Refer to Figure 3.5).

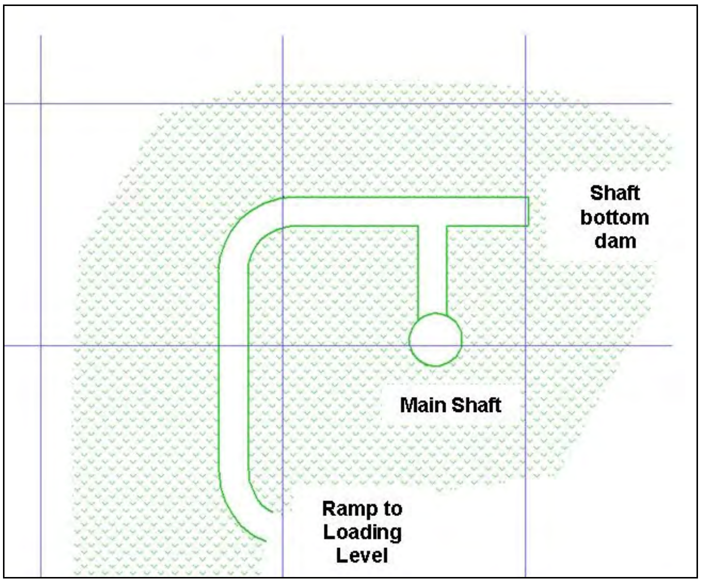


Figure 3.4 Shaft Bottom Layout

Two (2) fresh water dams (Refer to Section 3.7.2) will connect the settlers on the LMO level with the loading level.

The LMO level will be at an elevation of 536m, servicing the main production level and the underground crushing facilities which will be located here. This will be a double sided station arrangement with power feed cables that exit the shaft to feed the Main Substation located 20m North of the shaft (Refer to Figure 3.6).

Two (2) settling dams (Refer to Section 3.7.2) will be located south of the shaft, overlying the circular fresh water dams below.

The crusher chamber (10m x 12m x 10m deep) will be situated 68m to the east of the main shaft. ROM ore will be fed from the north and south into this area via conveyor belts (Refer to Figure 3.6).

Underground service bays will be developed for daily servicing, maintenance and repairs of all underground vehicles and mining machinery.

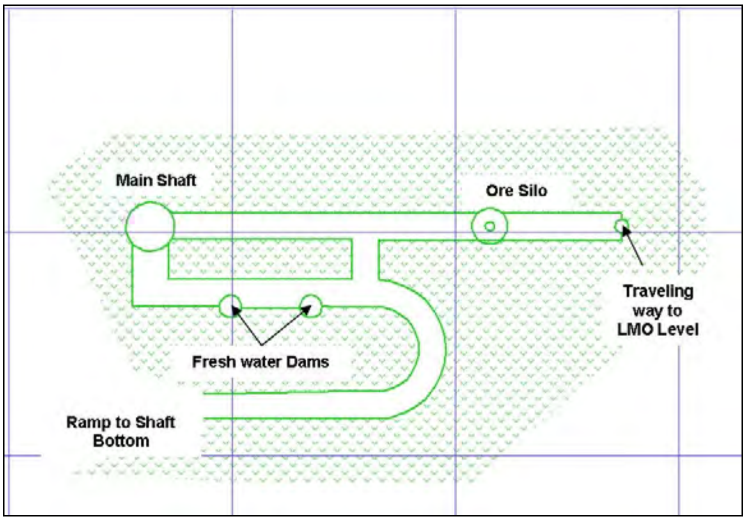


Figure 3.5 Loading Level Layout

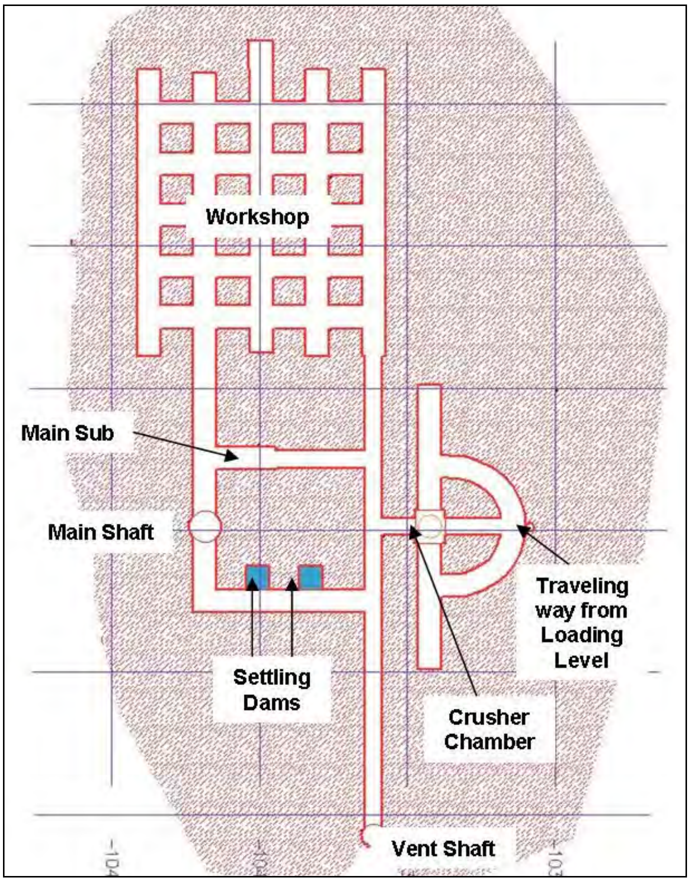


Figure 3.6 Main Level Layout

Ventilation Shaft

The ventilation shaft (S 27° 08' 57.884", E 22° 51' 59.304"), will be a total of 545m deep comprising of one station at shaft bottom. This vertical shaft will be circular and 8m in diameter. The shaft system is designed to meet the upcast ventilation requirements and also to provide the second means of egress in an emergency.

The shaft will be conventionally sunk to the pre-sink depth and then raise bored and slipped to the finished diameter of 8 m.

The ventilation shaft is situated to the southeast of the main shaft (Refer to Figure 3.6). Provision was made for a direct exhaust from the workshop, main sub and crusher areas to the ventilation shaft (Refer to Figure 3.6).

Mukulu Layout

The schematic section through the layout described above is presented in Figure 3.7. The LMO level is centered on the LMO while the loading level and shaft bottom are situated in the underlying Ongeluk lava.

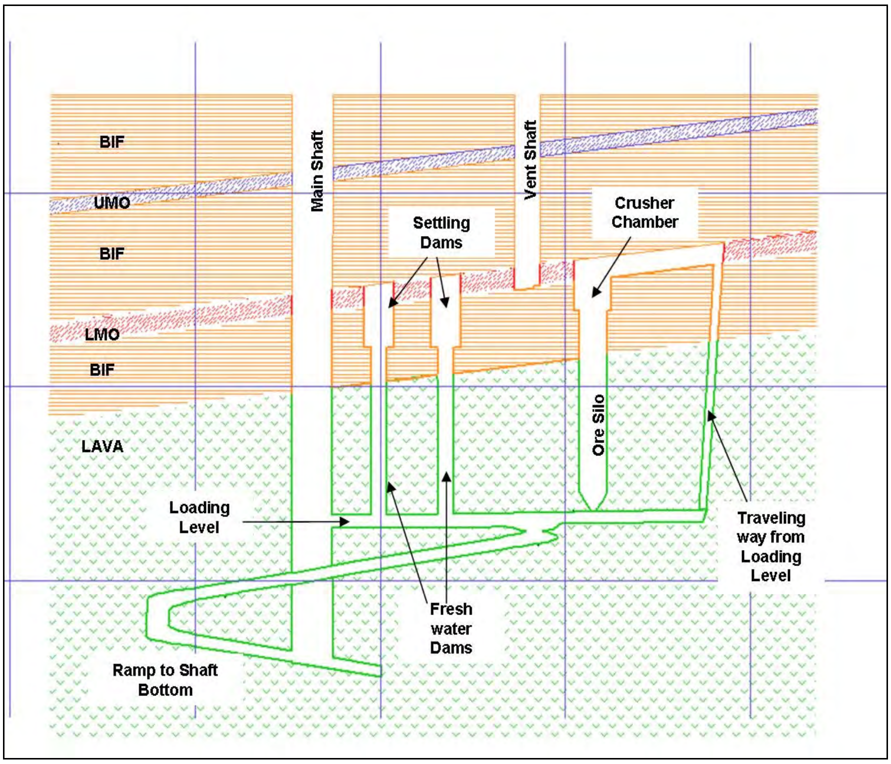


Figure 3.7 Section through capital layout- highlighting geology

3.3.4.2 Olivewood/Espom/Tigerpan

Main Shaft

The main shaft (S 27° 12' 0.298", E 22° 48' 01.210") (Refer to Figure 3.1) will be a total of 1 150m deep and comprise of three (3) stations. The UMO station will be at 1 001m below collar, the LMO station will be at 1 129m below collar and the loading level station will be at 1 067m below collar.

Ventilation Shaft

The ventilation shaft (S 27° 12' 3.839", E 22° 48' 01.204") will be a total of 1 065 m deep comprising of one station at shaft bottom.

3.3.4.3 Santoy and Belgravia

Main Shaft

The main shaft (S 27° 07' 48.400", E 22° 48' 27.439"), will be a total of 957m deep and comprise of three (3) stations. The UMO station will be at 807m below collar, the LMO station will be at 835m below collar and the loading level station will be at 873m below collar.

Ventiliation Shaft

The ventilation shaft is situated (S 27° 07' 51.976", E 22° 48' 29.430") and will be a total of 873m deep comprising of one station at shaft bottom.

3.3.5 Mining Schedule

3.3.5.1 Construction Phase

The pre-mining construction and access development will be undertaken over a two (2) year period:

- Construction of surface infrastructure to support mining;
- Shaft sinking and completion of underground infrastructure;
- Construction of the surface fines dump;
- Construction of the surface ore processing plant; and
- Construction of the rail spurs and load out facilities.

3.3.5.2 Access Completion and Block Development

Following the initial two (2) year phase described above, the completion of access and the block development of ore will be undertaken over a further one (1) year period. The projected production build-up over this one (1) year period is presented in Table 3.2.

Table 3.2 Production Build Up During Access Completion

DATE	WASTE TONNES	ORE TONNES	MN	FE	SI
Jan-16		33,815	40.521	17.229	2.495
Feb-16		38,147	42.197	17.007	3.014
Mar-16		52,758	45.950	15.509	3.208
Apr-16		78,771	46.634	11.755	2.894
May-16		95,122	47.450	12.908	3.613
Jun-16		75,076	48.345	11.258	3.937
Jul-16	6,720	58,791	48.052	11.437	3.591
Aug-16	20,462	51,299	50.129	12.057	3.463
Sep-16	9,408	65,470	46.149	12.249	4.211
Oct-16	7,146	69,571	42.580	12.550	5.149
Nov-16		78,500	43.645	11.759	4.514
Dec-16		71,014	44.118	12.149	4.619
TOTAL	43, 736	76, 8334	545.77	157.867	44.708

3.3.5.3 Operational Phase

The planned production of Mukulu Mine will be undertaken in the following phased manner:

- Mukulu: 2016 to 2045;
- Olivewood/Epsom/Tigerpan: 2025 to 2045; and
- Santoy and Belgravia: 2038 to 2045

The progression of mining in five (5) year time periods for the upper and lower orebodies on Mukulu is presented in Figure 3.8 to
Figure 3.12. The underground mine plan for the other two mining areas as described above, will be developed at a later stage, due to the fact that Main Street intends to develop these mining areas at least 10 years from the start of construction on Mukulu.

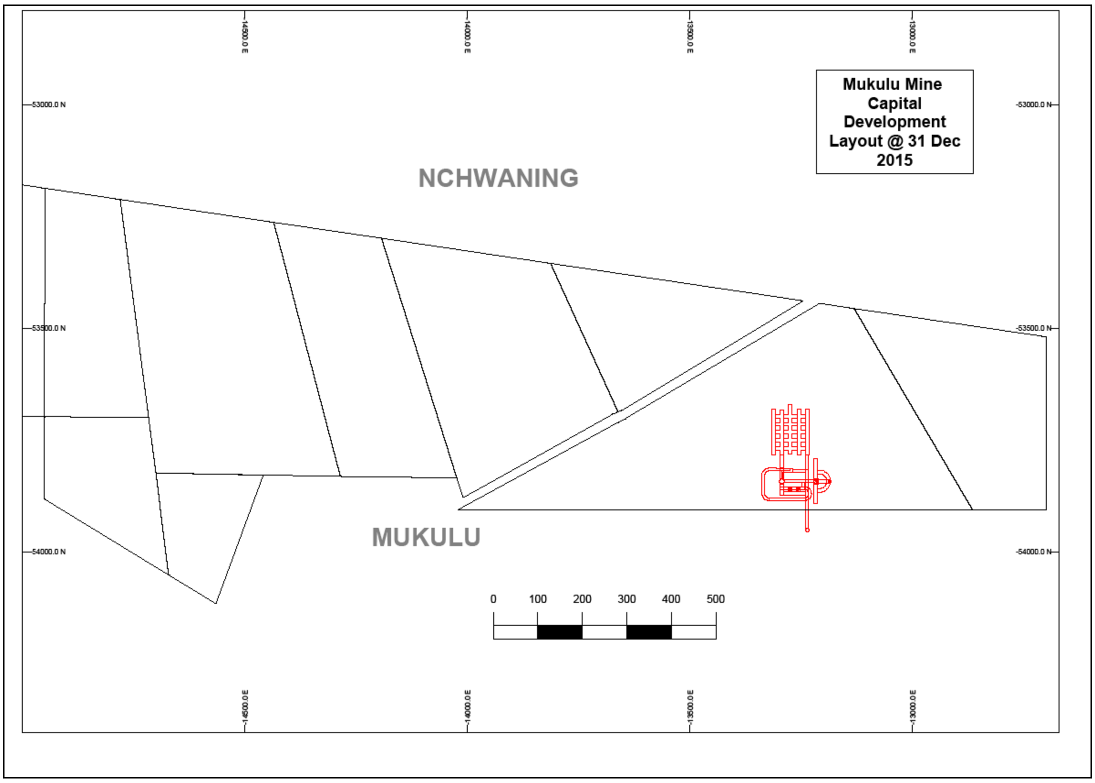
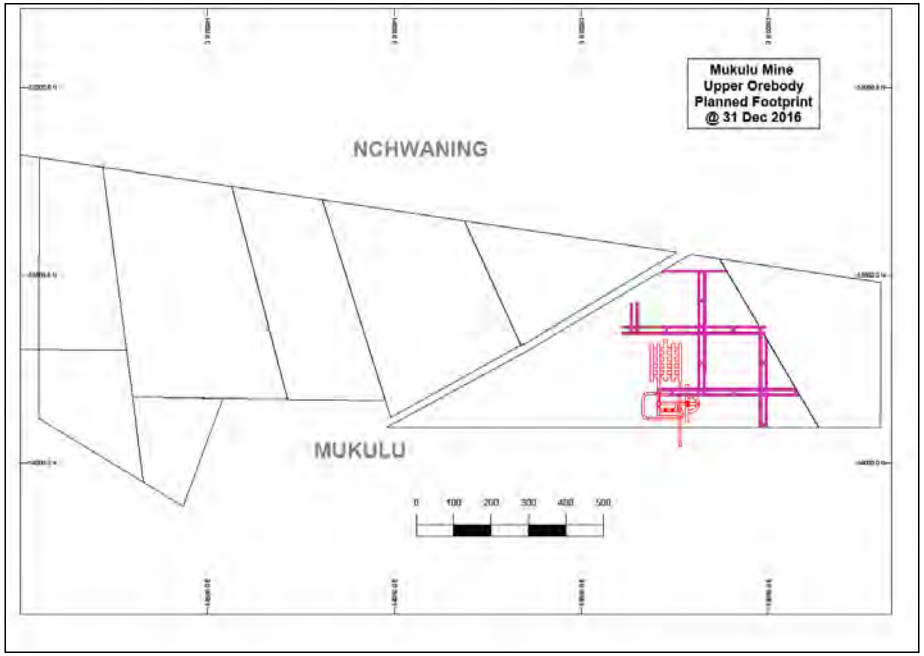
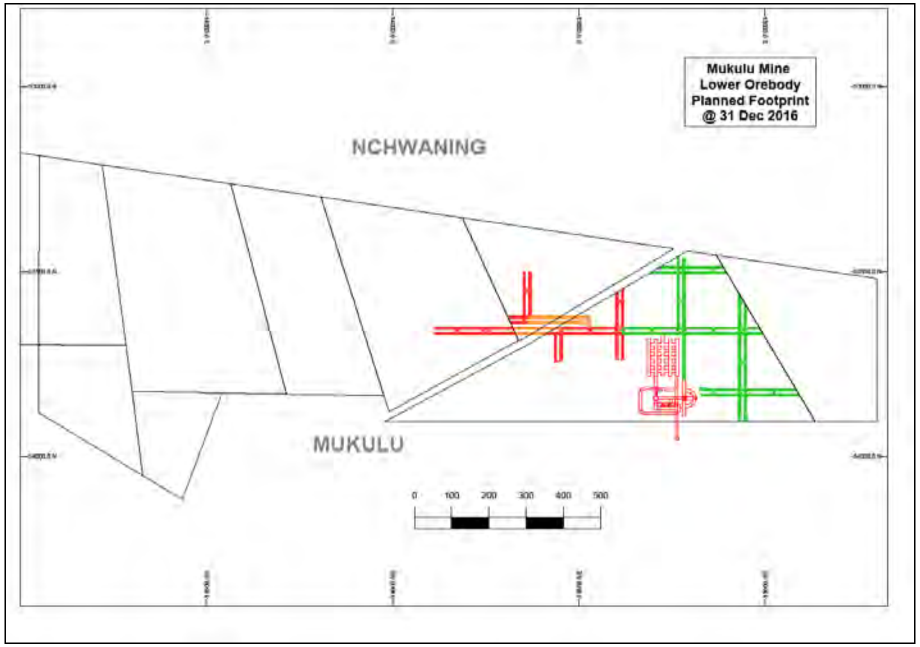


Figure 3.8 Mukulu Mine Capital Development by 31 December 2015

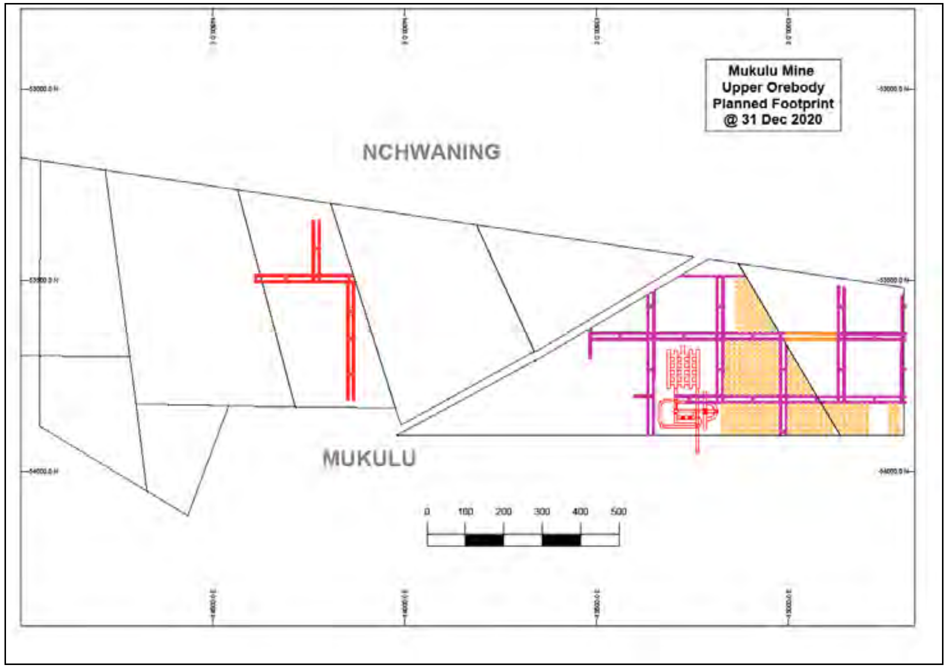


Upper Orebody

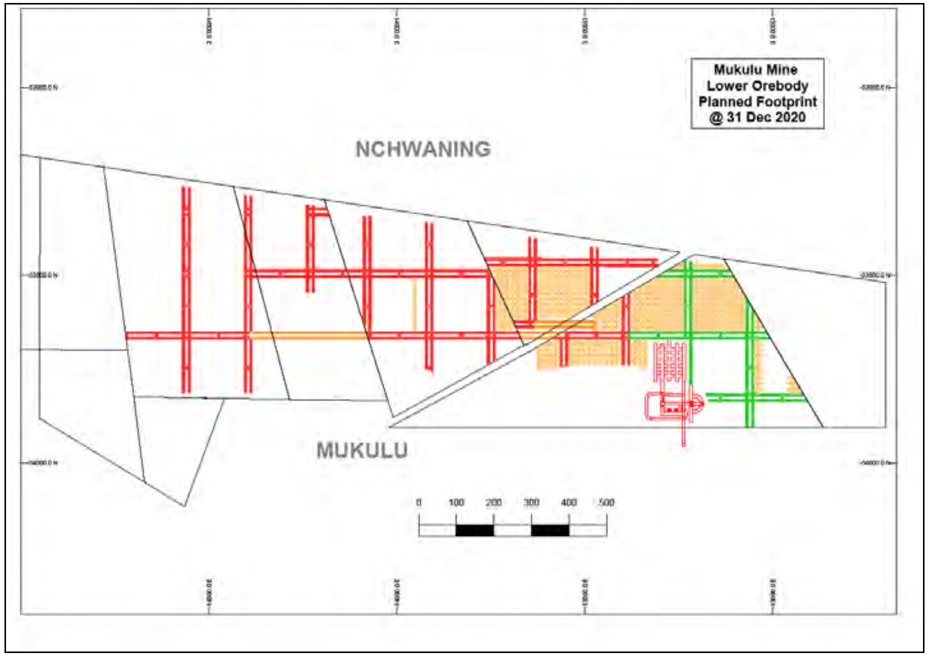


Lower Orebody

Figure 3.9 Mukulu Mine planned footprint by 31 December 2016

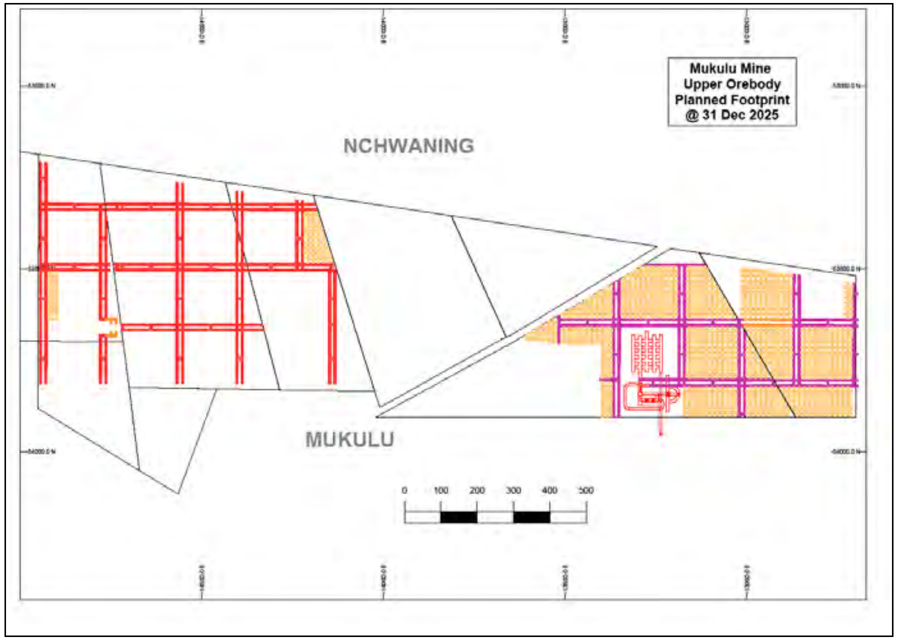


Upper Orebody

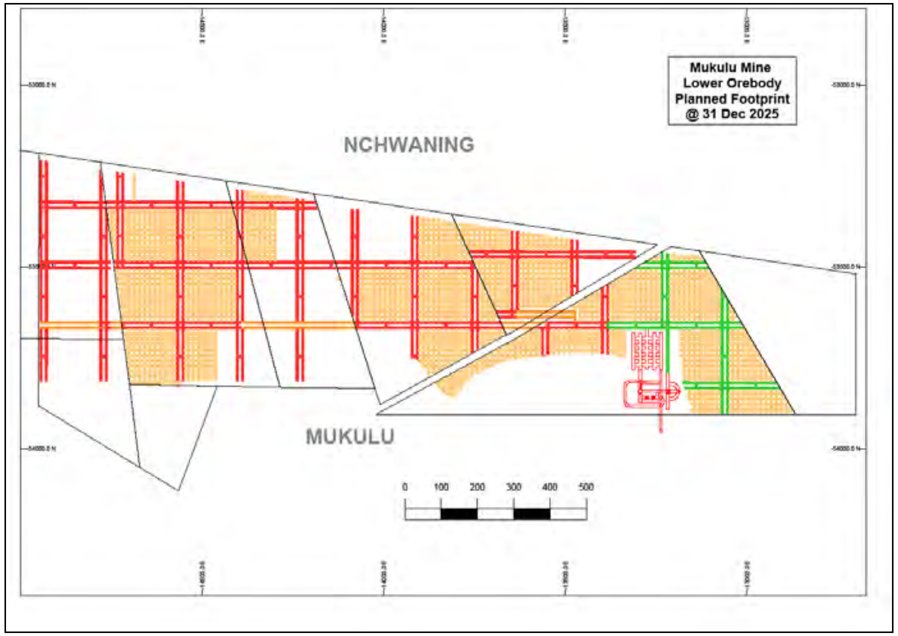


Lower Orebody

Figure 3.10 Mukulu Mine- planned footprint by 31 December 2020

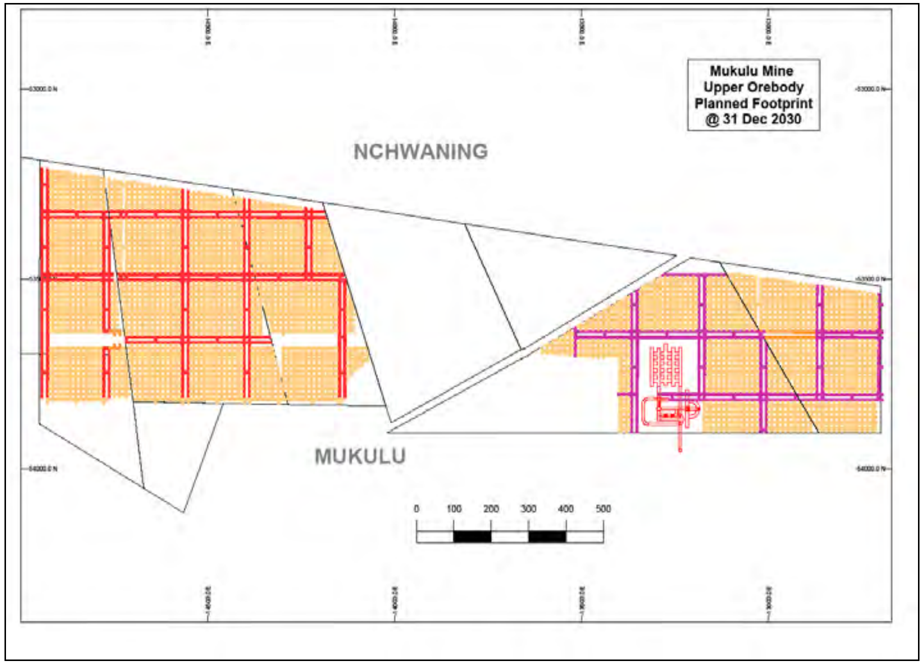


Upper Orebody

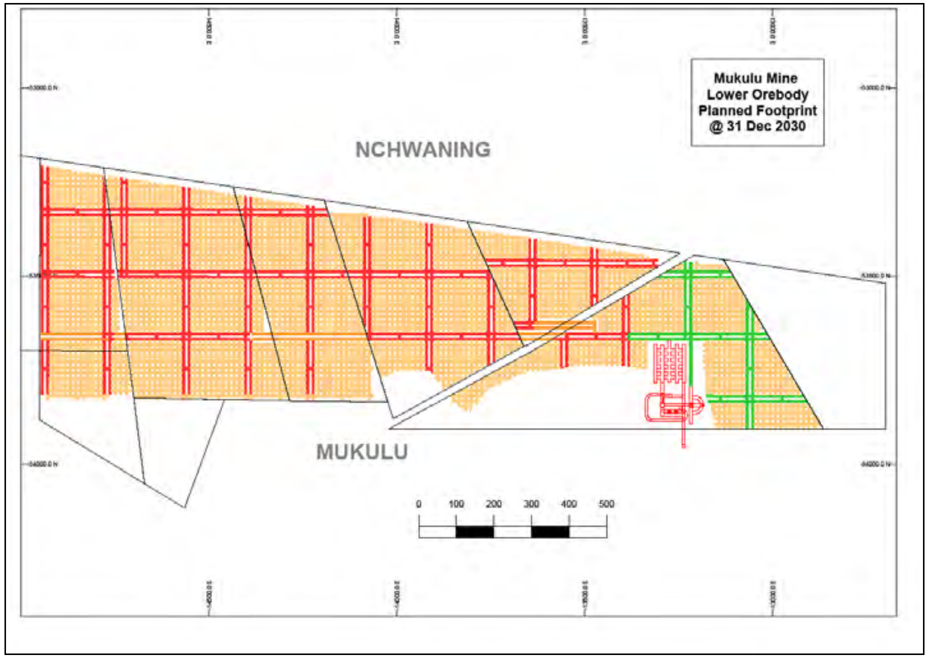


Lower Orebody

Figure 3.11 Mukulu Mine -planned footprint by 31 December 2025



Upper Orebody



Lower Orebody

Figure 3.12 Mukulu Mine- planned footprint by 31 December 2030

3.3.5.4 Production rate

Full production of 1 million tonnes per annum (high grade manganese) will be attained early in the second year of production (2018) and will be maintained until 2025. Once the mine at Epsom is phased in during 2025, the production will increase to 2 million tonnes per annum. In 2038 the operations at, Belgravia will be phased in and the annual production will increase to 2.5 million tonnes per annum. The projected production rate, as per the MWP (2011), is presented in Table 3.3.

Table 3.3 Mukulu Mine Production Forecast

DATE	WASTE TONNES	ORE TONNES
2016	43,736	768,334
2017	31,607	949,757
2018	37,834	999,969
2019		1,001,269
2020	35,706	1,003,749
2021	8,310	1,000,825
2022		1,000,684
2023		1,004,646
2024		1,003,101
2025		1,506,175
2026		1,503,951
2027		1,508,445
2028		2,097,614
2029		2,094,277
2030		2,013,760
2031	113,846	2,000,000
2032	66,558	2,000,000
2033	75,670	2,000,000
2034		2,000,000
2035		2,000,000
2036		2,000,000
2037		2,000,000
2038	142,308	2,500,000
2039	83,198	2,500,000
2040	94,588	2,500,000
2041		2,500,000
2042		2,500,000
2043		2,500,000
2044		2,500,000
2045		2,500,000

3.4 Mineral Processing

The processing of ore will require the following infrastructure:

- Underground Primary Crusher (jaw crusher);

- Rock breaker with a grizzly- to prevent blockages and to bypass fine ore;
- Underground Ore Silo- with a volume of 2 450m³ and the capacity to store 5 439 tonnes of ore;
- Secondary Crusher (on surface);
- Tertiary Crusher (on surface);
- Conveyors to feed ore from the main shaft, and over time, from the other two shafts on Olivewood and Belgravia;
- Front End Loader (FEL) at ROM ore stockpile; and
- Screen Feed bins at the Secondary and Tertiary Crusher.

The mineral process from the main shaft to the product stockpile area is presented in Figure 3.13 and described thereafter.

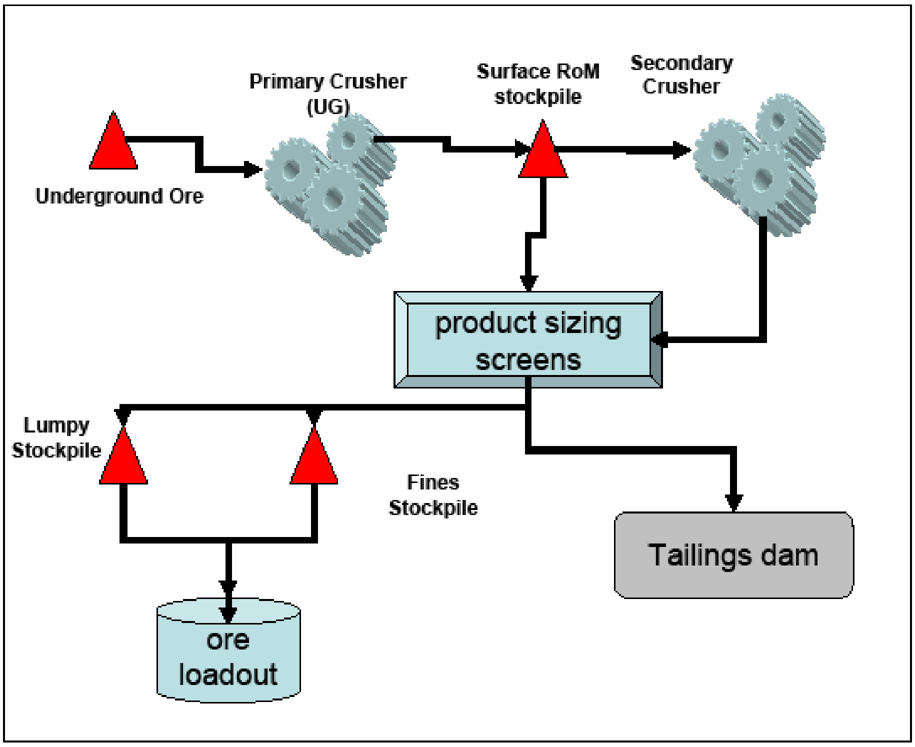


Figure 3.13 Proposed On-Mine Flow Diagram

Ore extracted during mining will be feed into the Underground Primary Crusher (jaw crusher). A rock breaker with a grizzly would be installed on the feed to prevent blockages and to bypass fine ore. The primary crusher will feed an underground ore silo. The layout of the underground crusher and ore silo is shown in the capital layout for Mukulu in Figure 3.7.

Ore will be reclaimed from the ore silo will be hoisted to the surface and stored in the ROM stockpile. From this stockpile a Front End Loader (FEL) via a conveyor will feed the secondary crusher. Fine mist water sprays will be turned on when ore enters the crusher to control dust generated by the crushing operation.

The secondary crushers would operate in closed circuit vibrating screens for sizing. The crusher chamber (10m x 12m x 10m deep) will be situated 68m to the east of the main shaft on Mukulu.

ROM ore will be fed to the secondary crusher from the north and south into this area via conveyor belts.

The conveyor will feed ore into the secondary screen feed bin. It is generally recommended that bins ahead of secondary/tertiary crushers and screens have a capacity equivalent to a minimum of 20 minutes throughput. Ore will be withdrawn from the bin with a pan feeder and fed to a grizzly screen with a cut-point of 75mm. The aperture size of the top deck can be changed to accommodate the different product particle size requirements of the markets. Screen undersize will be conveyed to the product sizing screen feed bin and the oversize to the secondary crusher feed bin. Ore will be withdrawn from the secondary crusher feed bin with a pan feeder and fed to the secondary crusher. Crusher product will be returned to the secondary screen feed bin.

Ore with a nominal top size of 75 mm will be withdrawn from the product sizing screen feed bin and fed to the product sizing screen. This double-deck screen has decks cutting at 6mm and 1.5mm. The screen will be operated as a washing screen to remove adhering fines from the product particles. The top-deck product will be the lump product, with a size range of -75 + 6mm. The bottom deck oversize will be -6 + 1.5mm and will be conveyed to the fines stockpile for either future sale or as possible sinter plant feed.

The bottom deck undersize (-1.5mm) is tailings. This stream will be cycloned in a dewatering cyclone. The tailings, in the form of a paste, will be stored in the PDF, to be located on Mukulu (Refer to Figure 3.1).

The Lump and Fines stockpile will be kept separate. Each stockpile area will have a capacity of 250,000t (which is equivalent to 3 months production). Trains will be loaded from the stockpiles.

The stockpiles will be located on concrete pads at the siding/load out area to make loading easier and cleaner.

All processes will be wet processes to reduce dust generation. Fines will be stockpiled for sale as and when the demand arises. Tailings and water will be separated in a large diameter thickener to recover the water for recycling as early as possible. Tailings will be pumped as a thick paste to a PDF with blanket and under wall drains and a concrete penstock.

The design tonnage throughput of the plant was selected based on marketing considerations. On this basis, the initial plant throughput was based on a lump product production rate of approximately 0.72 Mt per annum, equivalent to a run-of-mine (RoM) production rate of 1.0 Mtpa. The total saleable product (including fines) per annum is approximately 0.9 Mt.

3.5 Storage and Transport of Ore

Product from the beneficiation plant will be stored in separate stockpile areas located on concrete pads at the siding/load out area. From here, product will be loaded for transport via the railway from Hotazel.

3.6 Waste Management

Various waste streams which will be produced at the proposed mine as well as the disposal of these waste streams is discussed under this chapter.

3.6.1 Domestic waste

Domestic waste, which comprises of paper, plastic, organic waste, tins, building rubble, and drums, etc., will be collected in waste skips to be stored in a designated, bunded area, for collection on a weekly basis and disposal at a suitably licensed waste disposal site.

Main Street will obtain the necessary agreements to ensure that waste can be disposed of a suitably licensed facility.

3.6.2 Industrial/Mine waste

Mine waste produced at Mukulu Mine will comprise of:

- Waste Rock, produced during the completion of access to the ore resources will be disposed of within a waste rock dump area to be located north of the PDF on Mukulu 265 (Refer to Figure 3.1). The waste rock dump will be designed to contain approximately 733 361 tonnes of waste rock from the three shaft areas over the life of mine (LOM);
- Tailings produced at the beneficiation plant will be passed through a thickener to remove water. Water will be returned to the plant for reuse. The resulting paste will be pumped to a Paste Disposal Facility (PDF), to be located to the south of the plant on Mukulu 265. It is estimated that approximately 20l of water will remain for each 100kg of tailings pumped to the PDF:
  - The PDF will have blanket and under wall drains and a concrete penstock;
  - The PDF will have a Return Water Dam (RWD);
  - Tailings and water will be separated in a large diameter thickener to recover the water for recycling as early as possible. Tailings will be pumped as a thick paste to the TSF; and
  - It is not expected that any water will be recovered from the TSF penstock, except possibly during an exceptionally heavy rainstorm. Any penstock water recovered will pass to the RWD and be pumped to the plant water tank at the beneficiation plant.

3.6.3 Hazardous waste

Hazardous waste, which is generally comprised of used oils and lubricants, oily rags and scrap metal will be stored in a salvage yard located close to the workshop areas. The salvage yard will contain suitable waste bins for the sorting of waste. Once sufficient waste is collected, a contractor appointed by the mine will collect the waste for disposal at a suitably licensed waste disposal site.

Waste oils produced will be stored in designated oil drums within workshop areas for removal by an external contractor for reuse.

3.6.4 Sewage Facilities

Chemical toilets will be provided for use by workers during the construction phase of the proposed mine. A sewage package plant will be installed at the mine to service the various office and workshops during the operational phase of the mine.

Based on an estimated required workforce of 700 people and an estimated volume of between 120l and 140l of sewage (grey and black water) per day, the estimated annual throughput requirements of the sewage package plant, once the mine reaches full production is between 30 660m^3 and 35 770m^3 per annum.

The location and particular type of package plant required will be investigated further and the required detail will be obtained for submission as part of the IWULA to DWA.

This sewage package plant will require a waste management license (WML) in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA). Main Street will appoint an independent environmental assessment practitioner to undertake the application as soon as more details regarding package plant is available.

3.7 Water Storage and Management

3.7.1 Water Balance

A water balance was developed for the mine based on the production forecast, mine plan and estimates of quantities of ore fines which will be disposed of on the PDF, as well as an interpretation of the impact of activities described in the mine plan.

The water balance is conceptual as the mine plan is not sufficiently detailed to determine the specific water requirements. The breakdown and processes used suggests the following recovery of water per 1 00kg of ore extracted:

- 720kg of ore and 20l of water to Lumpy Stockpile;
- 180kg of ore and 6l of water to PDF;
- 100kg of ore particles and 242l of water to Discard Facility; and
- 600l of water recycled for reuse in ore processing.

Water availability could limit production rates. Water that is recycled for reuse and additional make-up water will be stored in underground storage facilities where evaporation losses are expected to negligible. These storage facilities will need to store volumes of water in the order of 25% (assumed) of the monthly production rate (in tonnes) (with production at 90 000 tonnes per month, 22 500m^3 of water is assumed to be available from storage).

The storage will need to be partly filled at the start of mining and the storage capacity may need to be increased as production rates increase. Water demands will be characterized by the assumed consumptive use of 260l of water per tonne extracted plus water required to fill or increase capacity of water stored underground and minus water pumped from working areas in a dewatering operation.

At this early stage, the volumes of water that will be available for dewatering are not known, many of the production figures are inferred from excavation drilling at a lower level of confidence and the efficacy of mining procedures still need to be tested.

For this reason and because of the fact that the mining plan has not been developed to include very specific details, a conceptual and provisional water balance model was developed that focuses on mining from Mukulu Shaft. The water balance will be updated at a later stage, once more definite input and output volumes are available. The conceptual water balance assumes the following:

- The supply of additional make-up water was assumed to be at least a constant supply of 12.5l/sec;
- Water from the underground dewatering is represented by values calculated in the GCS Hydrogeological (groundwater) study; and
- Abstractions from underground storage will occur at a rate of 860l/tonne of ore extracted and a lagged return flow of 600l/tonne of ore extracted will replenish storage.

The following parameters will affect the PDF:

- Suspended manganese micro-particles and dissolved manganese oxides are known to accrete and block drainage paths through soils and drains. While initial drainage at a high rate is likely, later rates of seepage into soils that underlie the PDF and return flows through drains in the walls of the PDF are likely to diminish with time. This effect o blocking natural drainage paths is likely to increase with any decrease in pH; and

- The local climate is characterized by extremely low rainfall and extremely high evaporation. Much of the water that ponds on the surface of the PDF is likely to rapidly evaporate.

The following was assumed to describe the processes in the discard facility:

- For each tonne of ore extracted, 100kg of suspended fines and 242l of water will be transferred to the PDF (Mining Works Programme (MWP), 2011);
- After an initial period of rapid infiltration, water from the PDF is likely to seep into underlying soils at an assumed rate of 0.4mm/day;
- Given the perceived safety concerns over discard facilities, escalating costs of drainage systems with deeper storage and potential blockage drains by dissolved manganese, it is suggested that the surface area of the PDF should be as large as possible and that the storage depth should be less than 10m if possible. This would mean that the PDF would cover an area of approximately 12ha;
- For each 100kg of tailings deposited, 20l will be stored between in voids between particles;
- It is assumed that 20l/tonne of ore processed and 10% of rainfall, over the surface area of the structure, will be drained from the discard facility, and rain, will be lost to evaporation; and
- At the RWD, all water not lost to evaporation will be reused within the defined dirty water area for dust suppression and in the plant.

Year	Excavation for Shafts		Ore	% Mn	Discard	Underground Storage	Tailings	Water Use	Voids	Seepage	Return Water	Evaporation	Dewater	Wa Dem
	m^3	tons	tons		tons	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m
2016	24992	43736	768334	45.8	76833.4	7683	51222.27	199766.8	17074.09	17520	18967	146206	37230	170
2017	18061	31607	949757	48.1	94975.7	9498	63317.13	246936.8	21105.71	17520	22595	185716	29200	219
2018	21619	37834	999969	47.9	99996.9	10000	66664.6	259991.9	22221.53	17520	23599	196651	30660	229
2019	0		1001269	48	100126.9	10013	66751.27	260329.9	22250.42	17520	23625	196934	38690	221
2020	20403	35706	1003749	48	100374.9	10037	66916.6	260974.7	22305.53	17520	23675	197474	41610	219
2021	4749	8310	1000825	47.9	100082.5	10008	66721.67	260214.5	22240.56	17520	23617	196837	45625	214
2022		Mukulu	1000684	48.2	100068.4	10007	66712.27	260177.8	22237.42	17520	23614	196807	53655	206
2023			1004646	47.9	100464.6	10046	66976.4	261208	22325.47	17520	23693	197670	54750	206
2024			1003101	48	100310.1	10031	66873.4	260806.3	22291.13	17520	23662	197333	58765	202
2025			1506175	48	150617.5	15062	100411.7	391605.5	33470.56	17520	33724	306891	59860	336
A	B	C	D	E	F	G	H	I	J	K	L	M	N	(

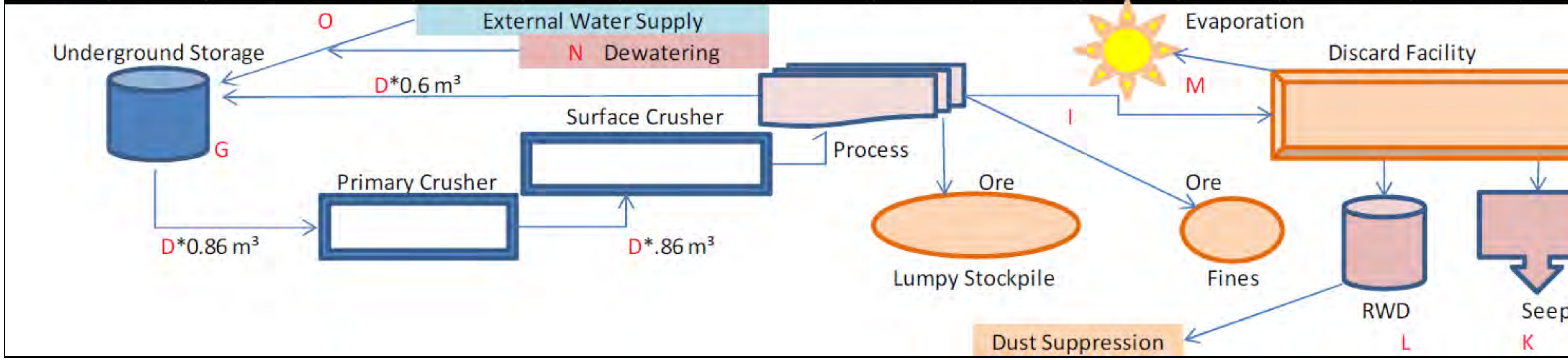


Figure 3.14 Conceptual Water Balance

Inflows	m^3	WATER BALANCE	m^3	Outflows
External Water supply	221850	Underground Storage	1506	Storage underground
Mine Dewatering	45005			
Return from Secondary Plant	614311			
Return Water Dam	77			
From PCD	776	Primary Plant Underground		
		Secondary Plant Surface	266201	Discard Facility
			614311	Return to Underground
From Secondary Plant	266201	Discard Facility	17520	Seepage
Rainfall on Surface	36000		237852	Evaporation
			22752	Storage in Voids
		Return Water Dam	77	Return to Underground
			6000	Dust Suppression
			18000	Evaporation
Rainfall on surface	10800	Pollution Control Dam	4000	Dust Suppression
Runoff From Catchment	1540		7564	Evaporation
			776	To Underground
	1196559	**AVERAGE BALANCE**	**1196559**	

Figure 3.15 Average Yearly Water Balance

3.7.2 Clean Water Storage Facilities

The following storage facilities are proposed for Mukulu Mine:

- Mukulu:
  - The main water supply will be routed to a fabricated steel storage tank, holding approximately two (2) days of total mine consumption. The tank will be mounted 10m above ground level to enable gravitational feed throughout the mine site. From here, water will be provided to the processing plant, underground works, change house, offices and workshops. Each supply area will be individually metered to enhance control and minimize wastage of water; and
  - Two (2) fresh water dams, with a combined capacity in excess of 1.5 million liters (1 500m^3) will connect the settlers on the LMO level with the loading level.

The required storage capacity for the shafts on Olivewood 284 and Belgravia 264 has not yet been determined. It is assumed that underground fresh water dams will also be constructed at these shafts.

3.7.3 Dirty Water Storage Facilities

The following facilities will store contaminated water:

- Return Water Dam (RWD) adjacent to the PDF. The required capacity of the RWD will be finalized once the relevant tailings engineer has designed the PDF;
- Pollution Control Dams (PCD):
  - A pollution control in the north-eastern corner of the farm Mukulu 265 is recommended, with a maximum capacity of 31 000m^3 to cater for the 1:50 year flood event. The dirty water catchment served by this PCD, as well as the proposed location of the PCD is presented in Figure 3.16;and
  - PCDs will also be required on Olivewood 284 and Belgravia 264. As there is no surface infrastructure planned for these proposed shaft areas, a dirty water area of 2ha was assumed. To service these catchments, PCDs of 750m^3 each will be required. The proposed locations of these PCDs are presented in Figure 3.17 and Figure 3.18 respectively;
- Two (2) settling dams will be located south of the main shaft on Mukulu 265, overlying the fresh water dams below (underground). The settler excavations will be 8m x 8m x 10m deep (640m^3).

3.7.4 Conceptual Storm Water Management Plan (SWMP)

Areas on a mine which contain stockpiles, loading bays, process plants, workshops and offices are all described as dirty water areas because of the perceived potential for pollution of local water resources. It is therefore important to contain runoff from these dirty areas and prevent contamination of surface water resources.

Regulation 77 of the NWA, limit mining activities within 100m of defined watercourses and stipulate that all storm to and including runoff generated by a 1:50 year flood event and, as far as possible, re-used to prevent pollution.

Dirty water must be trapped and stored (re-used where possible) while clean water must be diverted around dirty water areas.

A storm water management plan (SWMP) describes the measures which are required to prevent pollution of areas around the mine site. The conceptual SWMP developed for the proposed Mukulu Mine is limited to a conceptual layout of the main drains, berms and pollution control dams (PCD) which will be required to prevent clean water from entering a defined dirty water area and drains required to capture and store runoff generated within the dirty water area in PCDs, for later re-use or safe disposal.

A SWMP was developed for the surface infrastructure on Mukulu 265 as well as the proposed shaft areas on Olivewood 284 and Belgravia 264.

Mukulu:

The dirty water catchment for Mukulu 265 is 99ha, of which an 84ha area drains to the proposed PCD. The PDF was excluded from the area on which the size of the PCD was calculated, as this will drain into a RWD adjacent to the PDF facility.

The conceptual SWMP for Mukulu 265 is presented in Figure 3.16.

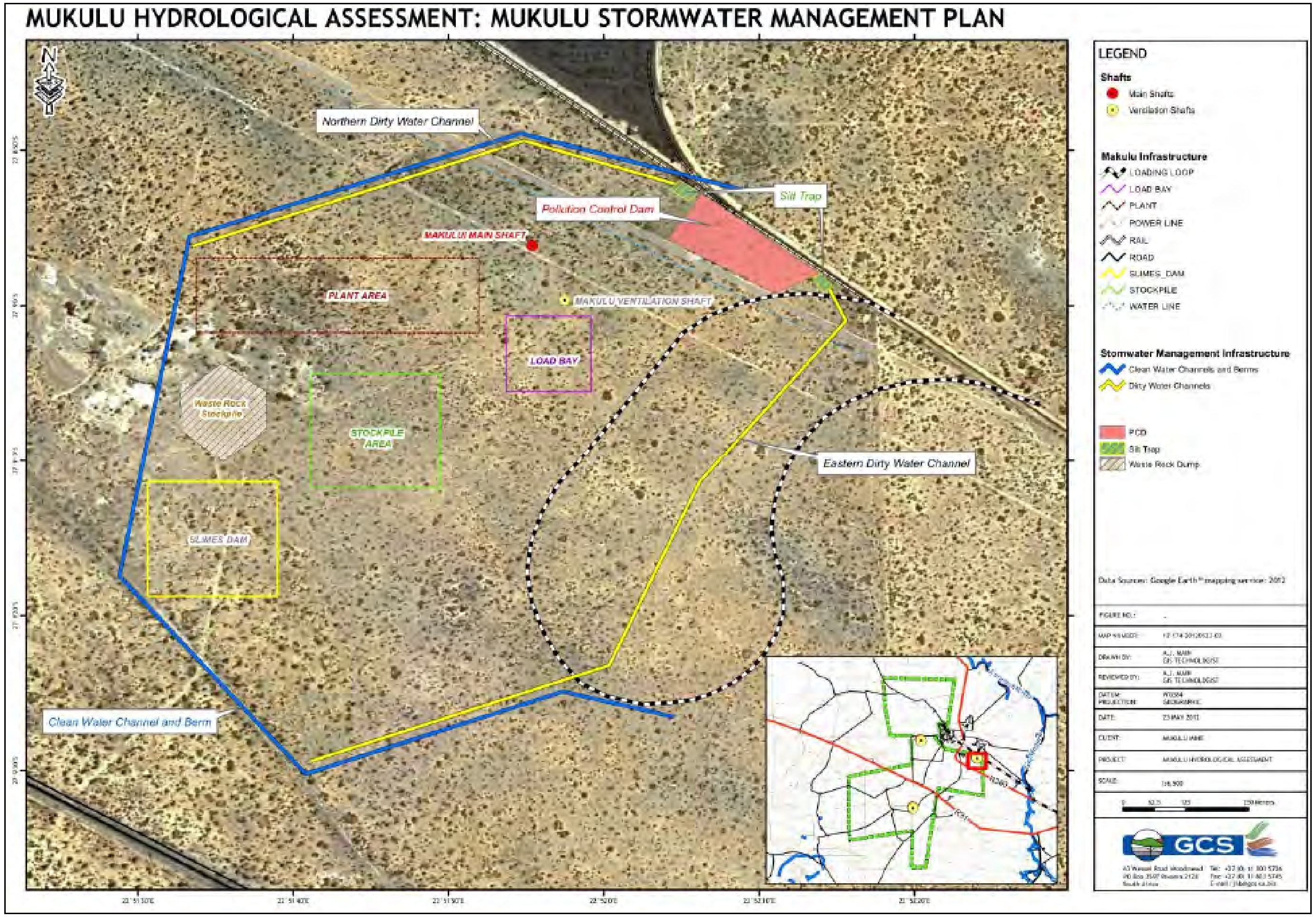
Olivewood and Belgravia:

Areas surrounding the proposed shafts on Olivewood and Belgravia were restricted to 2ha, as no surface infrastructure is currently planned for these areas. At this stage, the ore from the underground mine will be conveyed to the ROM stockpile to be situated on Mukulu 265.

The PCDs for these areas will not exceed 750m^3 each. Most of the water contained in these PCDs will evaporate. It is proposed that this water is used for dust suppression where possible.

The proposed shaft on Belgravia appears to be adjacent to a local calcrete pan, where it would appear that water is pumped into this less permeable depression to provide drinking water for stock and game. It may be necessary to move the proposed shafts, or provide an alternative watering hole site.

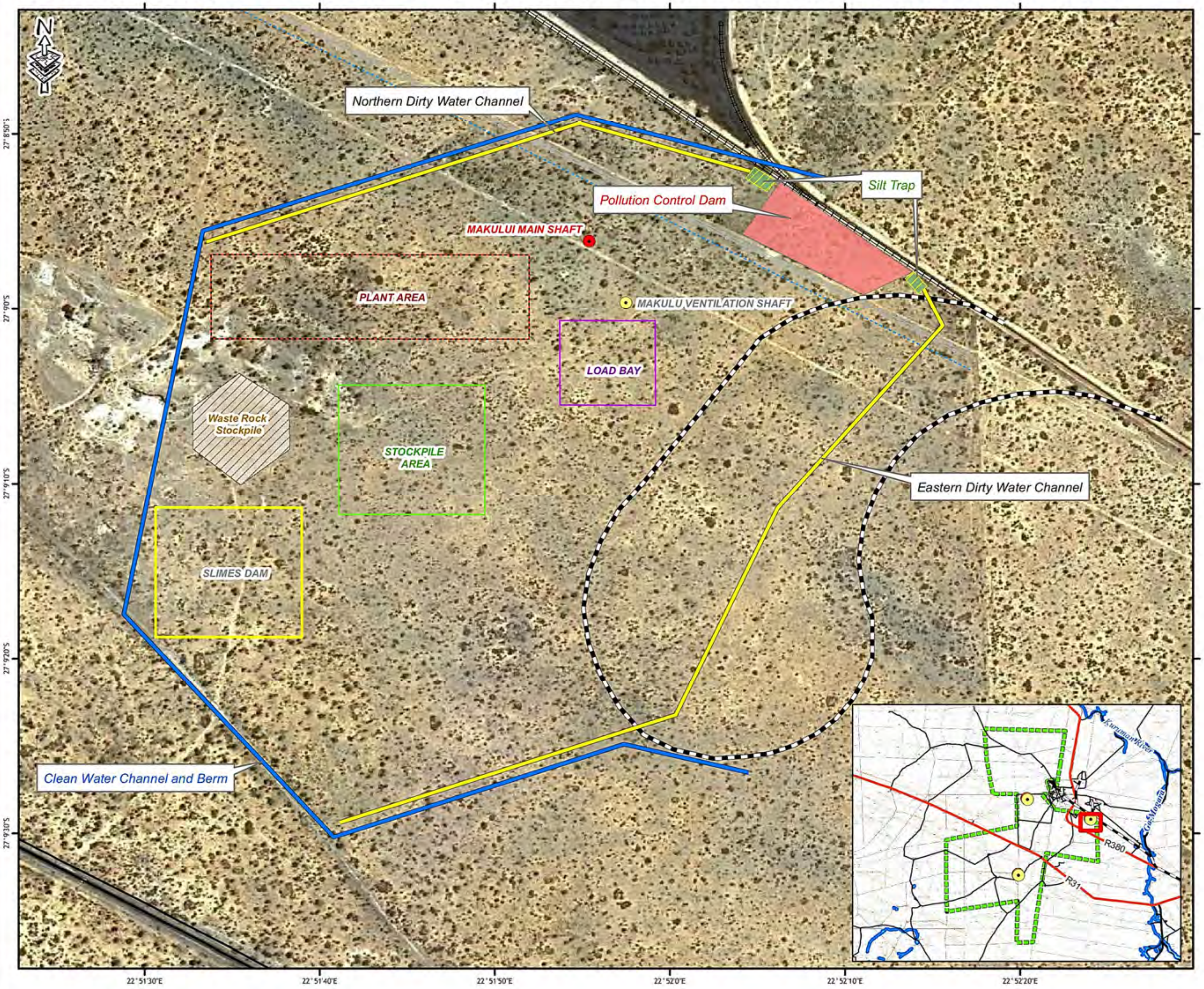
The conceptual SWMP for Olivewood and Belgravia is presented in Figure 3.17 and Figure 3.18 respectively.



[Figure not to scale- refer to A3 figure attached]

Figure 3.16 Conceptual SWMP for Mukulu 265

MUKULU HYDROLOGICAL ASSESSMENT: MUKULU STORMWATER MANAGEMENT PLAN



LEGEND

Shafts

- Main Shafts
- Ventilation Shafts

Makulu Infrastructure

- LOADING LOOP
- LOAD BAY
- PLANT
- POWER LINE
- RAIL
- ROAD
- SLIMES_DAM
- STOCKPILE
- WATER LINE

Stomwater Management Infrastructure

- Clean Water Channels and Berms
- Dirty Water Channels
- PCD
- Silt Trap
- Waste Rock Dump

Data Sources: Google Earth™ mapping service: 2012

FIGURE NO.:	-
MAP NUMBER:	12-174-20120523-03
DRAWN BY:	A.J. MAIN GIS TECHNOLOGIST
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	23 MAY 2012
CLIENT:	MUKULU MINE
PROJECT:	MUKULU HYDROLOGICAL ASSESSMENT
SCALE:	1:6,500

0 62.5 125 250 Meters

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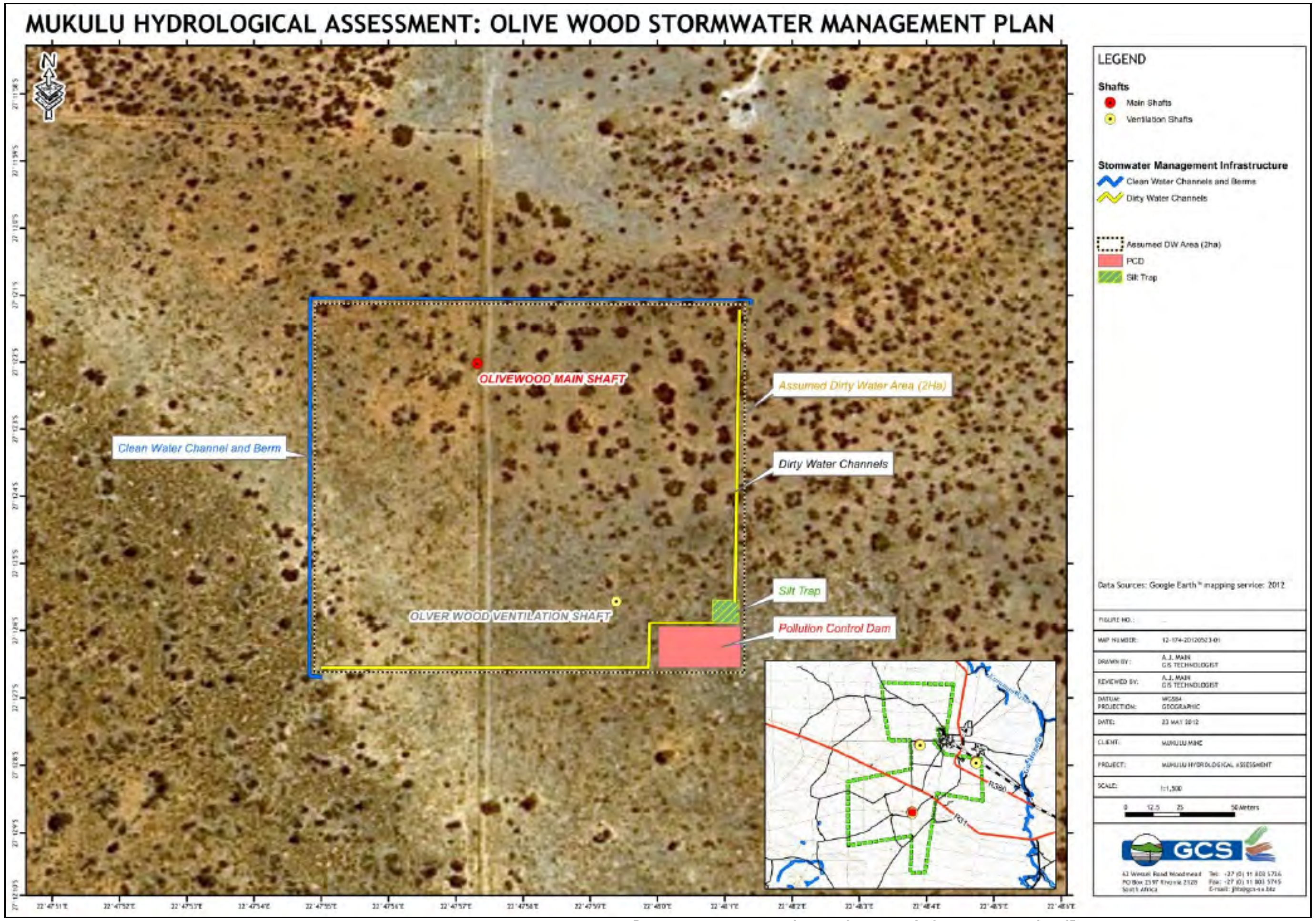
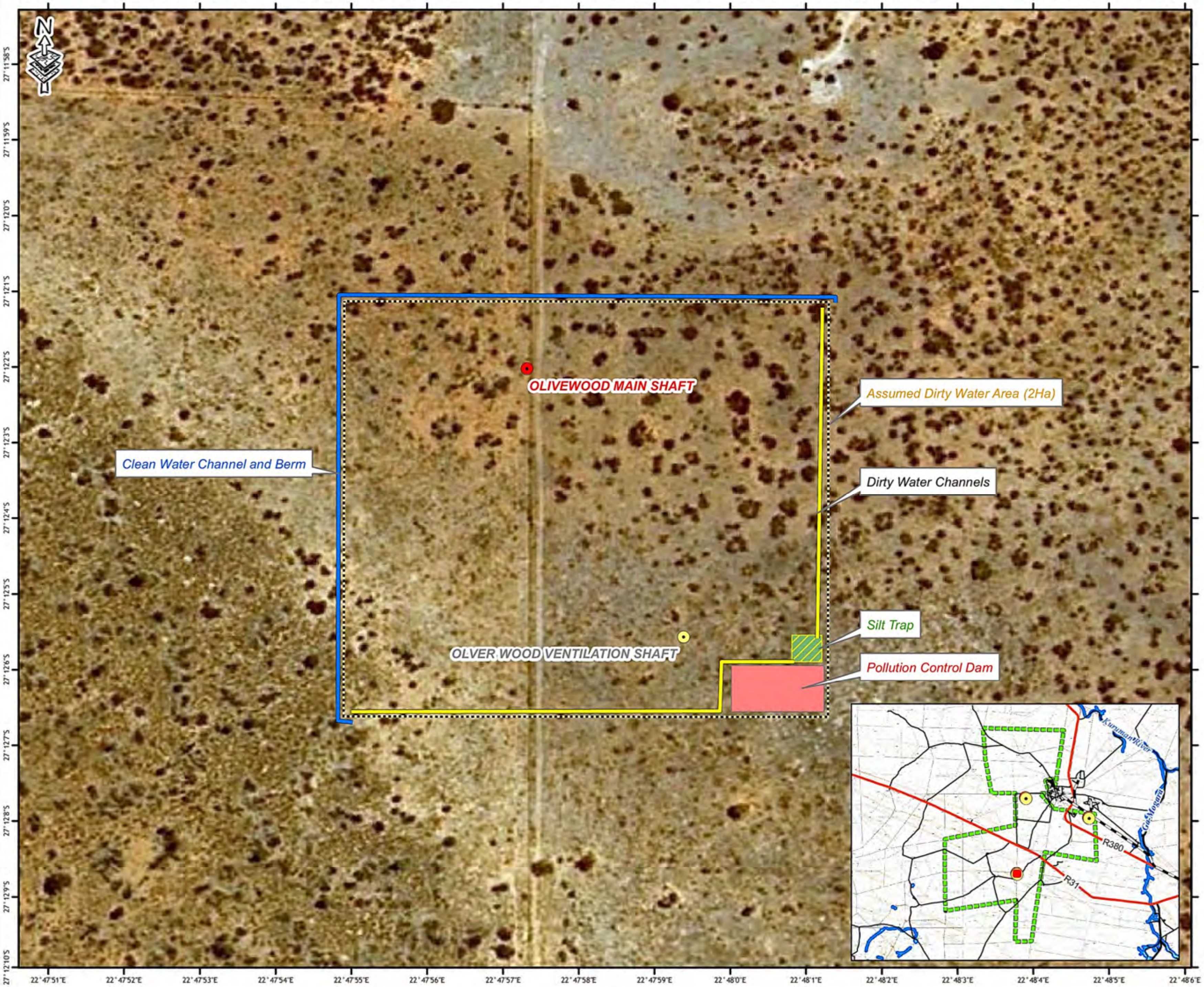


[Figure not to scale- refer to A3 figure attached]

Figure 3.17 Conceptual SWMP for Olivewood 284

MUKULU HYDROLOGICAL ASSESSMENT: OLIVE WOOD STORMWATER MANAGEMENT PLAN



LEGEND

Shafts

- Main Shafts
- Ventilation Shafts

Stomwater Management Infrastructure

- Clean Water Channels and Berms
- Dirty Water Channels
- Assumed DW Area (2ha)
- PCD
- Silt Trap

Data Sources: Google Earth™ mapping service: 2012

FIGURE NO.:	-
MAP NUMBER:	12-174-20120523-01
DRAWN BY:	A. J. MAIN GIS TECHNOLOGIST
REVIEWED BY:	A. J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	23 MAY 2012
CLIENT:	MUKULU MINE
PROJECT:	MUKULU HYDROLOGICAL ASSESSMENT
SCALE:	1:1,500

0 12.5 25 50 Meters

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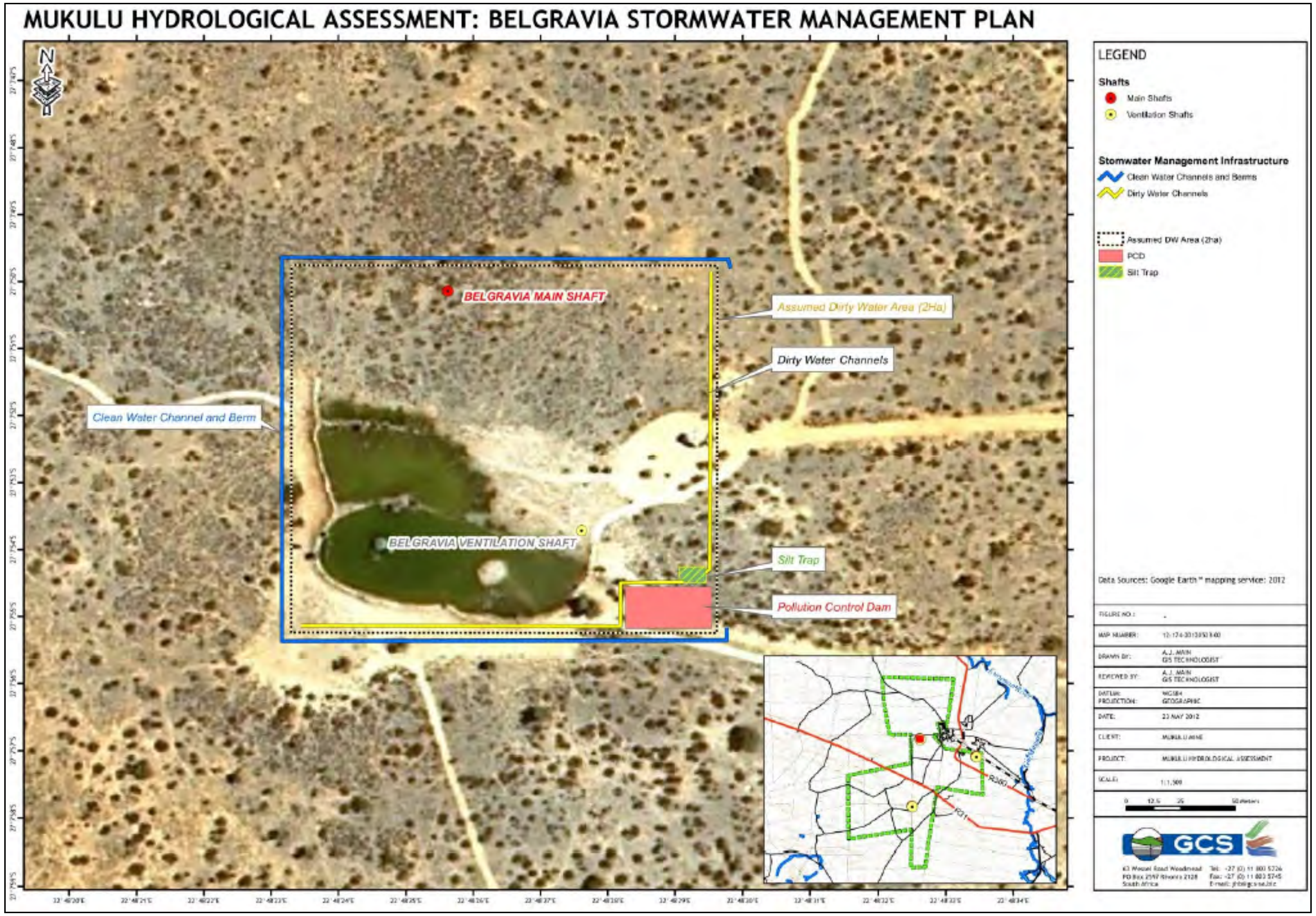

[Figure not to scale- refer to A3 figure attached]

Figure 3.18 Conceptual SWMP for Belgravia 264

MUKULU HYDROLOGICAL ASSESSMENT: BELGRAVIA STORMWATER MANAGEMENT PLAN

LEGEND

Shafts

- Main Shafts
- Ventilation Shafts

Stomwater Management Infrastructure

- Clean Water Channels and Berms
- Dirty Water Channels
- Assumed DW Area (2ha)
- PCD
- Silt Trap

Data Sources: Google Earth™ mapping service: 2012

FIGURE NO.:	-
MAP NUMBER:	12-174-20120523-02
DRAWN BY:	A. J. MAIN GIS TECHNOLOGIST
REVIEWED BY:	A. J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	23 MAY 2012
CLIENT:	MUKULU MINE
PROJECT:	MUKULU HYDROLOGICAL ASSESSMENT
SCALE:	1:1,500

0 12.5 25 50 Meters

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3.8 Water Supply

3.8.1 Potable Water

Based on the water balance study, the estimated water demand for the proposed Mukulu Mine, for the first 10 years of production (before the shafts on Olivewood 284 and Belgravia 264 are phased in) is 221 850^3 per annum. This volume excluded the potable water requirements for the proposed offices and shafts.

Main Street intends to obtain the required potable water from the Vaal Gamagara Water Scheme, managed by Sedibeng Water via bulk water meter.

Main Street will initiate discussions with Sedibeng Water and will determine the cost implications and environmental authorization requirements associated with the construction of the required infrastructure to obtain water from the scheme.

Water which is provided to the processing plant, underground works, change house, offices and workshops will be metered to minimize wastage.

3.8.2 Process Water

Most of the process water will be obtained from potable water supply. It is anticipated that the main uses of process water at the mining operation will be:

- Dust suppression for haul roads and stockpiles;
- Screening;
- Tailings (paste) deposition;
- Plant cleaning; and
- General evaporation (evaporation in the area exceeds rainfall).

In order to comply with best practices, the mine will be operated as a zero discharge operation.

The mine make –up water will be obtained from all water which is recovered from the processing of ore, dewatered from the underground operations, as well as runoff from dirty water areas will be captured and reused in the process to reduce the amount of water required from the Vaal Gamagara Scheme.

The following sources of water will provide process water for the Mukulu Mine (Refer to the water balance under Section 3.7.1):

- Water removed from tailings (approximately *614 311m³ per annum)*. Tailings and water from the processing of ore will be separated in a large diameter thickener to recover water. Water which has been separated from tailings will be stored temporarily for reuse in the processing plant. The location of the storage facility/dam will be finalized during the NWA WULA process;
- Dewatering from Mukulu Shaft (approximately *45 005m³* of water per annum);
- RWD (approximately 6 077m³ per annum);
- PCD (approximately 8776m³ of water per annum); and
- The re-use of treated water from the sewage package plant will be investigated. This option is dependent on the water quality which the package plant will be able to attain. It is estimated that the sewage treatment plant will have an annual throughput of between 21 900m³ and 25 550m³.

The reuse of water will further serve to reduce the required capacity of the dirty water dams.

3.9 Power Supply

Main Street will obtain the power supply to the Mukulu Mine from Eskom, by means of an 11kv substation to be located in close proximity to the main plant.

An Eskom power line will be required on Mukulu. The proposed power line will traverse the north-eastern corner of the farm Mukulu 265. Eskom has indicated that a power line is currently being constructed in the area, and that the electricity requirements for the Mukulu Mine will be factored in once an application for electricity supply is lodged with Eskom.

3.10 Workshops, Administration and other buildings

Buildings will be located at various locations within the mine area. It is envisaged that the following buildings (permanent and prefabricated structures) will be constructed for the mine:

- Workshop north of the main shaft on Mukulu 265;
- Administration buildings; and

- Security office at mine access area.

No residential area will be constructed to house employees. It is envisaged that employees will be housed in the nearby towns of Kuruman and/or Kathu. Main Street will investigate the feasibility of providing transport to the mine and housing options.

3.11 Hydrocarbon Storage

It is envisaged that diesel storage bays will be located at each shaft on Olivewood and Belgravia and at the workshop area on Mukulu.

Diesel will be stored in suitable diesel storage tanks, within areas bunded with concrete and will cater for a minimum of 110% capacity. The estimated diesel storage requirements, at this stage, is approximately $500m^3$

3.12 Linear Infrastructure

3.12.1 Roads

The proposed mine will be accessed via a surfaced road from the R380 road which traverses Mukulu 265 in a north-easterly from the R31 near Hotazel.

It is anticipated that less than 2km of road construction is required between the R380 and the mine surface infrastructure on Mukulu 265. The access road will offer the opportunity for the transport of ore via road, should this transport option be required in the future.

3.12.2 Railways

Main Street intends to transport ore for the local market and for export from the mine via rail. Two options are being investigated to provide rail transport:

- ***Option A:*** The Assmang owned rail line traverses the eastern corner of Mukulu 265. It is envisaged to use this rail line to transport ore to Hotazel where the national Transnet network to the dedicated manganese port in Port Elizabeth starts. A short spur as well as a loading station will be built and this will require a total of 3.8 km of railway track construction.

- ***Option B***: Failing to secure the use of the Assmang railway to Hotazel, the feasibility of constructing a rail line to link with the Transnet railway in Hotazel will be investigated.

Option A is the preferred alternative, and negotiations are underway with Assmang regarding the use of their railway line. Main Street has also initiated negotiations with Transnet regarding the use of their railway line between Hotazel and Port Elizabeth.

In the event that Assmang gives consent, it is anticipated than an agreement in principle will be reached between Main Street and Assmang during the NEMA environmental authorization application process.

3.12.3 Power lines

The mine plan reticulation will be provided at 11kV, with the main substation situated in close proximity to the main processing plant. The substation will be within the first level of security access of the mine enabling easy access for maintenance personnel.

Eskom has indicated that a power line is currently being constructed in the area, and that the electricity requirements for the Mukulu Mine will be factored in once an application for electricity supply is lodged with Eskom.

3.12.4 Conveyors

It is envisaged that the transportation of ore will be undertaken via conveyors to be constructed between the shafts on Mukulu 265, Olivewood 284 and Belgravia 264 and the processing plant to be located on Mukulu 265.

The route of the conveyors will be finalized once the landowner consultation process is completed and land use agreements are negotiated between Main Street and the relevant landowners.

The final product from the plant will be stored in a product stockpile to be located adjacent to the plant before being transported from the mine via road or rail.

3.13 Residential Developments

No residential developments are proposed for the proposed mine. Main Street intends to house workers in Kathu and/or Kuruman and transport workers daily by bus to the mine.

4 PROJECT ALTERNATIVES

This section describes the project alternatives which have been considered, including alternative land uses, thereby fulfilling the requirements as per Regulation Section 50 (b) of the MPRDA Regulation R527 and the DMR EMP Template.

REGULATION 50 (b)

- *(Section 1 - 4): The alternative land use or developments that may be affected.*
  - *(Section 1- 4.1): Concise description of the alternative land use of the area in which the mine is proposed to operate.*
  - *(Section 1 - 4.2): List and description of all the main features and infrastructure related to the alternative land uses or developments.*
  - *(Section 1 - 4.3): Plan showing the location and aerial extent of the aforesaid main features of the alternative land use and infrastructure related to alternative land developments identified during scoping.*

4.1 Ore Transport Alternatives

4.1.1 Rail Transport

Currently, the only dedicated manganese terminal in South Africa is in Port Elizabeth Samancor, Assmang and United Manganese of Kalahari (UMK). Expansion of the port at PE is not possible due to environmental constraints.

According to reports (the P.E Herald newspaper, www.nelsonmandelabay.gov.za and www.coega.co.za) in March and April 2012, Transnet is moving ahead with plans to relocate the existing dedicated manganese terminal in Port Elizabeth to the new port in Ngqura which was officially opened in March 2012. (This decision was made prior to two (2) feasibility studies exploring the potential for shipping manganese from Saldanha versus Ngqura (Coega), conducted in conjunction with the industry, being finalized).

Rail transport is preferred as it will be cheaper, per tonne to transport ore to the port at Nqura than by road. Main Street has already entered into discussion with Transnet to negotiate an agreement for the use of the future railway from Hotazel to Nqura.

4.1.2 Road Transport

As mentioned in the previous section, the cost of transporting ore by rail is lower than using road transport, therefore the use of the Transnet railway line if preferred.

The benefit of using rail transport is that the mine will not have a large impact on the roads in the region.

4.2 Infrastructure Alternatives

4.2.1 Railway Link

- ***Option A:*** The Assmang owned rail line traverses the eastern corner of Mukulu 265. It is envisaged to use this rail line to transport ore to Hotazel where the national Transnet network to the dedicated manganese port in Port Elizabeth starts. A short spur as well as a loading station will be built and this will require a total of 3.8 km of railway track construction.
- ***Option B***: Failing to secure the use of the Assmang railway to Hotazel, the feasibility of constructing a rail line to link with the Transnet railway in Hotazel will be investigated.

Option A is the preferred alternative due to costs and presence of infrastructure, and negotiations are underway with Assmang regarding the use of their railway line. Main Street has also initiated negotiations with Transnet regarding the use of their railway line between Hotazel and Port Elizabeth.

In the event that Assmang gives consent, it is anticipated than an agreement in principle will be reached between Main Street and Assmang during the NEMA environmental authorization application process.

4.3 Mining methods Alternatives

Due to the depth of the mineral reserves opencast mining is not feasible. As a result the only mining method in which to access the reserves is via underground mining methods.
The bord and pillar mining method is commonly used in underground mines in the Kalahari Manganese Field. This mining method recovers the ore from open stopes and leaves pillars to support the roof. In order to recover the maximum amount of ore, the smallest possible pillars are left for support without compromising the stability of the roof. This mining method is considered the most suitable for the underground mining of manganese, therefore no mining method alternatives have been considered.

4.4 Land Use Alternatives

The current land use within the Mukulu Mine area is dominated by game and cattle farming, with horses on a few farms endurance riding. The good quality grass makes this area suitable for grazing purposes.

Although alternative land uses are described in this section, it must be noted that, with the exception of the farm Mukulu 265, based on the proposed mine plan, most of the land uses within the project area are unlikely to be impacted on and changed by the proposed new mine. In most instances, these activities will be able to continue.

4.4.1 Tourism

The project area is located within the Joe Morolog Local Municipality of the John Taolo Gaetsewe District Municipality. The main economic activity in the district municipality is mining, followed by agriculture, tourism and retail.

Tourism has been identified as one of the priority industries within the Joe Morolong Local Municipality. The 2010/2011 Spatial Development Framework (SDF) for the John Taolo Gaetsewe District Municipality, states that various areas adjacent to the rivers are well suited for tourism and agricultural development alike. The proposed project area is a considerable distance from any rivers in the region. Furthermore, the Hotazel area has been identified as a service and mining development node

The use of the land within the project area for game farming as well as the proposed mining activities need not be mutually exclusive. Based on the proposed mine plan, which indicates the location of surface infrastructure on the farm Mukulu 265, which is adjacent to the existing Assmang Black Rock Mine, it is envisaged that the current land use on the remaining properties within the project area may continue.

4.4.2 Residential

The closest residential areas to the Mukulu Mine area is Black Rock to the north-east and Hotazel which is 8km to the east of the project area. The current land use is game and cattle farming.

The proposed project area is not regarded as area which has the potential for residential development due to how sparsely populated the region is and the limited diversity of job opportunities (mining dominated) within the immediate area.

4.4.3 Grazing/Cultivated Land

The Mukulu Mine is currently being used for game and cattle farming. It is envisaged that these activities may continue within these areas once mining commences.

The John Taolo Gaetswe District Municipality SDF states that the land with high agricultural potential should be preserved and utilised as such.

This region, however, is not suited to the production of arable agricultural products owing to the low rainfall. Consequently there is no record of any significant form of agricultural production in the project area. Filed surveys further confirmed this as there was no evidence of historical or recent dryland or irrigated crop production.

4.4.4 Mining

The proposed Mukulu Mine is adjacent to the existing Assmang Black Rock Mine. The proposed surface infrastructure for the mine will be located on the farm Mukulu 265 which has been subject to prospecting activities and contains disturbed areas which indicate historical mining activities.

The vicinity of the proposed mine to existing operations, the sparsely populated nature of the project area and immediate surrounds, as well as the results of discussions with landowners (refer to chapter 5 of this document) indicate that mining is a viable land use for the proposed project area.

4.5 No-Go Option

If the no-go option were applied, the land uses within the proposed Mukulu Mine area would continue with the land use and activities that are currently in place, namely game and cattle farming.

There would be no impacts (or cumulative impacts due to the development of the proposed Mukulu mine adjacent to the existing Assmang Black Rock Mine) created within the project area due to the proposed mining activities. The area will, however, continue to be impacted on, although to a lesser extent, by the grazing of animals.

The project area is located adjacent to an existing mine and will result in underground mining activities and as a result the current land use activities can continue with the exception of the area where the mining infrastructure will be placed which belongs to the neighbouring mine.

A rejection in this application will result in the loss of opportunity to supply the local and export markets with manganese resources as geological resources' location are site specific.

Specialist studies have not indicated any specific fatal flaws and all impacts can be managed to a low significance. However, should the no-go option apply none of the potential impacts will be present.

Applying the no-go option will prevent the creation of various employment and socio-economic opportunities:

- Job creation and related capacity building and skills transfer;
- Conversion and diversification of economy;
- Enhanced transport and rural accessibility; and
- Creation of business opportunities for local entrepreneurs.

Based on the project description provided in Chapter 3 of this report, which includes the proposed mine plan provided by the applicant, as well as assumptions made by the EAP, it is the opinion of the EAP that the project will not result in any significant impacts

4.6 Product Alternatives

4.6.1 Carbonated ore mining and sintering

Significant amount of low grade carbonated ore have been already discovered on the farm Mukulu 265.

Based on knowledge of the regional geology, Main Street will conduct an exploration campaign in the south of Mukulu mining project area to extend the reserves by discovery of carbonated ore.

Main Street will study the feasibility of mining carbonated ore as well as rich oxidised ore as planned in the mining work programme.

This study will include the construction of a sinter plant, in order to enhance the grade of carbonated ore. The possibility of adding value to the ultrafine of oxidised ore produced during crushing will be looked at.

Extraction of carbonated ore would increase the mine life, the size of the project, as well as the number of jobs to be created.

4.6.2 Metallurgy

Main Street will study the feasibility of setting up a smelter in South Africa for production of Silico-manganese and/or ferro-manganese depending on availability of electricity and infrastructure and tax environment.

4.7 Benefit / Motivation of the Project

The proposed Mukulu Mine, if developed will create both negative and positive impacts. The negative impacts will be prevented, mitigated and managed through the implementation of the measures set out in this EMP. The EMP furthermore includes proposed measures to enhance positive impacts. The benefits of the proposed project include:

- Job creation over the life of mine (project LoM of 29 years);
- Positive contribution to the economy of the district municipality, Northern Cape Province as well as the national economy;
- The creation of procurement opportunities for local entrepreneurs (contractors, suppliers, transport providers, etc.); and
- The establishment and upgrading of infrastructure within the project area.

Also refer to the no-go option under section 4.5.

5 PUBLIC PARTICIPATION PROCESS

This chapter describes the stakeholder engagement process undertaken, as well as the proposed process to be undertaken during the NEMA application process, thereby fulfilling the requirements as per Regulation 50 (f) of the MPRDA Regulation R527 and headings 11 to 13.

REGULATION 50 (f):

- *(Section 11): Identification of interested and affected parties. (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report).*
- *(Section 12): The details of the engagement process. (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report and any further consultation since the compilation of the scoping report).*
- *(Section 13): Details regarding the manner in which the issues raised were addressed. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*

The proof of public consultation is attached under Appendix D of this report.

5.1 Purpose of public participation

5.1.1 Rationale for Consultation

According the DMR “Guideline for Consultation with Communities and Interested and Affected Parties”:

‘The purpose of consultation with the landowner, affected parties and communities is to provide them with the necessary information about the proposed prospecting or mining project so that they can make informed decisions, and to see whether some accommodation with them is possible insofar as the interference with their rights to use the affected properties is concerned. Consultation under the Act’s provisions requires engaging in good faith to attempt to reach such accommodation.’

5.1.2 Legal Requirements

The public participation process (PPP) forms an integral part of the environmental authorization application in terms of the following legislative processes:

- MPRDA: Section 48 (f) and 49(f) respectively of the MPRDA regulation R527, published in terms of Section 107(1) of the MPRDA Government Gazette No. 26275, dated 23 April 2004;
- NEMA: Chapter 6, R543, Government Gazette No. 33306 dated 18 June 2010; and
- NWA: Section 41 (4) of the NWA provides that the competent authority (DWA) may, at any stage of the application process, require the applicant to place a suitable notice in newspapers and other media, and to take other reasonable steps as directed by the competent authority to bring the application to the attention of relevant organs of state, interested persons and the general public.

Due to the legislative requirements listed above, the public consultation process has been integrated as far as possible to present all environmental authorization application processes to Interested and Affected Parties (I&APs).

5.2 Identification of Interested and Affected Parties (I&APs)

The following stakeholder groups were identified and informed of the project:

- Landowners;
- Lawful occupiers of land- with the exception of Tigerpan 186, all other properties are not occupied by tenants;
- Local, provincial and national authorities;
- Utilities (Eskom, Transnet and Sedibeng Water); and
- Members of the public within the Hotazel, Kuruman and Kathu areas.

The stakeholder database for the Mukulu Mine is provided under Appendix D of this report.

5.2.1 Landowner Consultation

Landowners were consulted with in the following manner *Refer to the proof of public consultation attached under Appendix D:

- Letters were sent to Assmang Ltd (Black Rock) Mine with regards to the MRA over the properties which belong to Assmang;

- Telephonic communication (no proof of telephone calls—the record of these is presented in the stakeholder database);
- Written communication sent via email and post; and
- Landowner consultation meeting held on 10 May 2012 in Hotazel (Refer to the description under Section 5.2.4.1 of this report).

5.2.2 List of Authorities consulted

The following authorities were informed, in writing, of the project application processes being undertaken:

- Joe Morolong Local Municipality;
- John Taolo Gaetswe District Municipality;
- Northern Cape Department of Environment and Nature Conservation;
- Department of Mineral Resources;
- Provincial South African Heritage Resources Agency: Northern Cape;
- Department of Water Affairs;
- Northern Cape Department of Agriculture and Land Affairs; and
- Land claims Commission.

All the above listed authorities were automatically registered as I&APs on the stakeholder database developed for the project.

5.3 Notification of Stakeholders

Various methods of written notification were utilized to inform the I&APs. The process undertaken thus far is described in this section of the report and proof thereof is attached under Appendix D of this report.

Each of the documents which were used to notify stakeholders and the public of the project contained the following information:

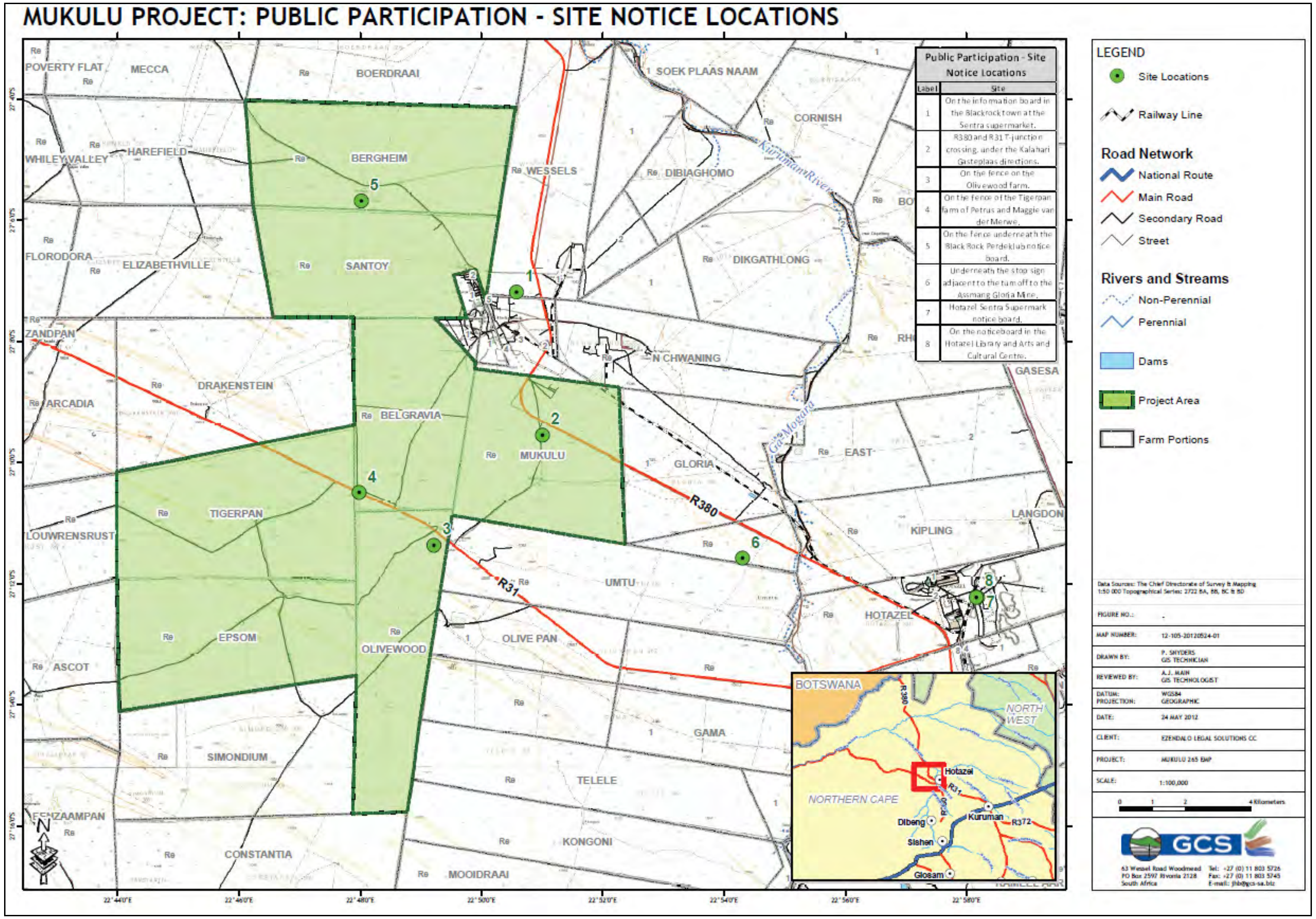
- The geographic location of the project;
- The name of the applicant;
- The reference numbers issues for the MRA and environmental authorization application which were issued by the DMR and NCDENC respectively;

- The applications being undertaken in terms of the MPRDA. NEMA and NWA;
- The listed activities being applied for in terms of the NEMA regulations;
- An invitation to register as an I&AP;
- The contact details and deadline for registration; and
- Notification that a public meeting will be held to present the project (as part of the NEMA and NWA), informing the public that all registered I&APs will be informed of the date, time and venue for the public meeting once these details have been finalized..

5.3.1 Site Notices

Site notices (English and Afrikaans) were placed at eight (8) areas around the project area. The locations where these site notices were placed are shown in Figure 5.1 and the copy of the site notices and proof of placement (photographs) is presented in the proof of public participation document under Appendix D. The locations are described below:

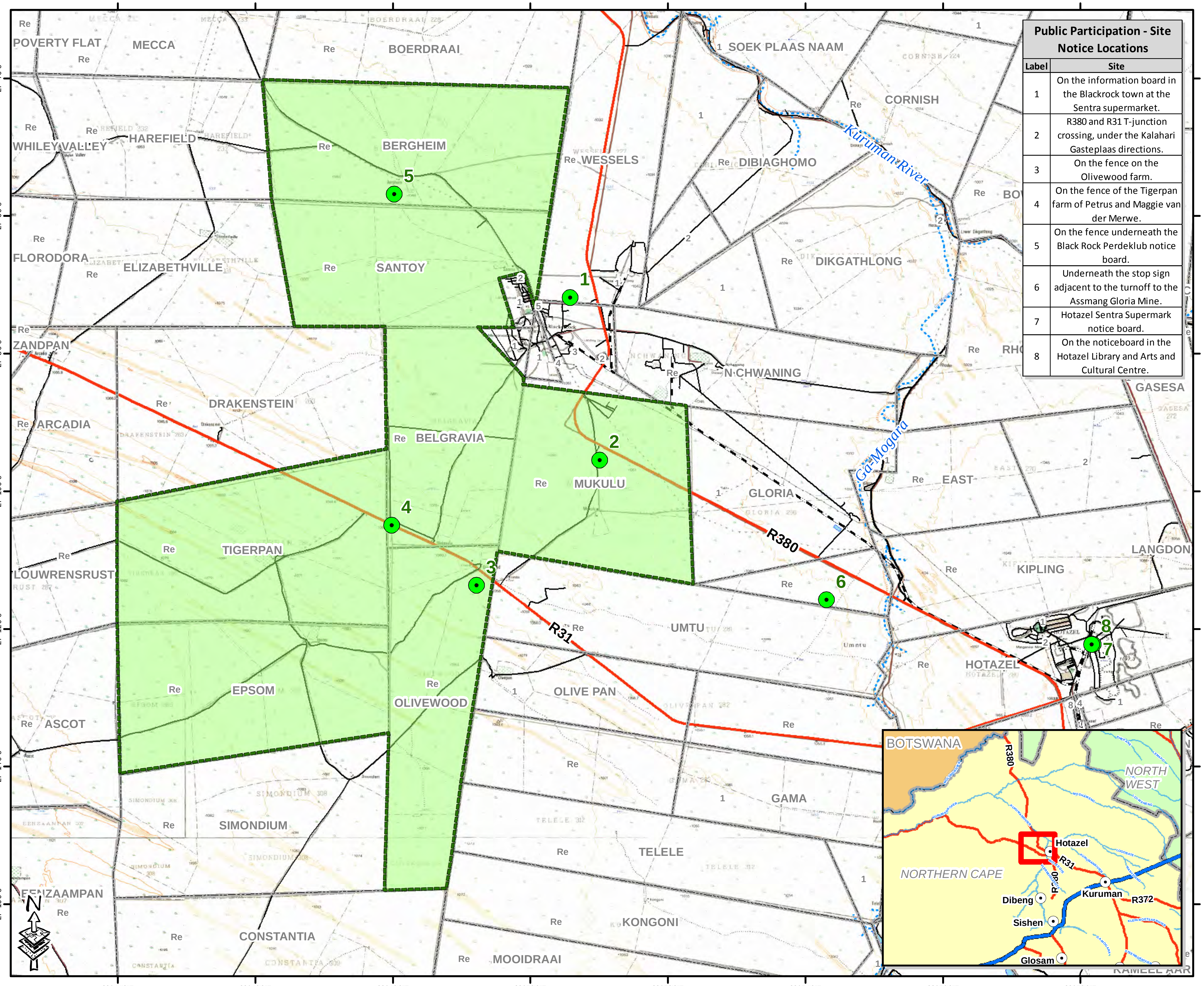
- Information board in the Blackrock town at the Sentra supermarket)27°07'111'' S; 22°49'944'' E);
- R380 and R31 T-junction crossing, under the Kalahari Gasteplaas directions (27°09'328''S; 22°51'003''E);
- On the fence on the Olivewood farm (27°10'821''S; 22°48'727''E);
- On the fence of the Tigerpan farm of Petrus and Maggie van der Merwe (27°10'297''S; 22°47'586''E);
- On the fence underneath the Black Rock Perdeklub notice board (27°05'409''S; 22°48'009''E);
- Underneath the stop sign adjacent to the turnoff to the Assmang Gloria Mine (27°10'947''S; 22°54'181''E);
- Hotazel Sentra Supermark notice board (27°12'135''S; 22°57'711''E); and
- On the notice board in the Hotazel Library and Arts and Cultural Centre. (27°12'135''S; 22°57'697''E).



[Figure not to scale- refer to A3 figure attached]

Figure 5.1 Location of Site Notices

MUKULU PROJECT: PUBLIC PARTICIPATION - SITE NOTICE LOCATIONS



Public Participation - Site Notice Locations

Label	Site
1	On the information board in the Blackrock town at the Sentra supermarket.
2	R380 and R31 T-junction crossing, under the Kalahari Gasteplaas directions.
3	On the fence on the Olivewood farm.
4	On the fence of the Tigerpan farm of Petrus and Maggie van der Merwe.
5	On the fence underneath the Black Rock Perdeklub notice board.
6	Underneath the stop sign adjacent to the turnoff to the Assmang Gloria Mine.
7	Hotazel Sentra Supermark notice board.
8	On the noticeboard in the Hotazel Library and Arts and Cultural Centre.

LEGEND

- Site Locations
- Railway Line

Road Network

- National Route
- Main Road
- Secondary Road
- Street

Rivers and Streams

- Non-Perennial
- Perennial
- Dams
- Project Area
- Farm Portions

Data Sources: The Chief Directorate of Survey & Mapping
1:50 000 Topographical Series: 2722 BA, BB, BC & BD

FIGURE NO.:	-
MAP NUMBER:	12-105-20120524-01
DRAWN BY:	P. SNYDERS GIS TECHNICIAN
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	24 MAY 2012
CLIENT:	EZENDALO LEGAL SOLUTIONS CC
PROJECT:	MUKULU 265 EMP
SCALE:	1:100,000

0 1 2 4 Kilometers

GCS

63 Wessel Road Woodmead
PO Box 2597 Rivonia 2128
South Africa
Tel: +27 (0) 11 803 5726
Fax: +27 (0) 11 803 5745
E-mail: jhb@gcs-sa.biz

5.3.2 Media advertisement

An advertisement (English and Afrikaans) was placed in the Kalahari Bulletin on Thursday, Thursday, 17 May 2012.

The copies of both advertisements are presented under Appendix D, and the proof of placement is shown in Figure 5.2 and Figure 5.3

16 KALAHARI BULLETIN, DONDERDAG 17 MEI 2012

122 Boedels

D. Thebe

Duvenhage & Van Der Merwe Ing.

In die boedel van wyle Dora Thebe, identiteitsnommer 540604 0251 088, getroud binne gemeenskap van goedere met Kedumetse Gilbert Thebe in lewe van Huis D747, Morokweng, distrik Kuruman.

Boedelnommer 547/2012

Skuldeisers en skuldenaars in bogemelde boedel word versoek om hul vordering in te lewer en hul skulde te betaal by die kantore van ondergenoemde binne 30 (dertig) dae vanaf 18 Mei 2012.

DUVENHAGE & VAN DER MERWE
Posbus 63
Kuruman
8460

J.J. van Wyk

KBVS Prokureurs

In the estate of late JJ van Wyk, identity number 420417 5123 086 of Informal Site 2083, Welgeleë, Olifantshoek.

Estate number: 2387/2008

The first and final liquidation and distribution account in the abovementioned estate will be open for inspection of all persons with an interest therein for a period of 21 (twenty one) days from 18 May 2012 at the office of the Master of the High Court, Kimberley and the Magistrate, Olifantshoek.

KBVS ATTORNEYS
PO Box 565
51 Beare Street
Kuruman
8460

N.A. Molale

KBVS Prokureurs

In die boedel van wyle Naledi Alec Molale, identiteitsnommer 710306 6088 084 van Anemoonstraat 14, Kuruman en nagelate gade Solofelang Millicent Molale.

Boedelnommer: 575/2011

Die eerste en finale likwidasie- en distribusierekening in bogenoemde boedel sal vir 'n tydperk van 21 (een en twintig) dae vanaf 18 Mei 2012 ter insae lê by die Meester van die Hooggeregshof, Kimberley en van die Landdros Kuruman.

KBVS PROKUREURS
Posbus 565
Bearestraat 51
Kuruman
8460

48 Volwasse ontspanning en vermaak

WARRIOR VIAGRA: Nou in Kuruman beskikbaar. Sterker, langer ereksie. Hou 10 keer langer uit. Verbeter jou sekslewe ten volle. 100% geldterugwaarborg. 100% veilig (medies getoets). 073 894 5273 073 522 8346. **Beskikbaar by Jimmy's Drankwinkel, h/v Livingston- en Shortstraat, Kuruman.**

AANDAG ALLE ADVERTEERDERS

Die gebruik van die letter "A", leestekens soos "!" of "@" of die gebruik van syfers met die doel om die advertensie na die bopunt van die klassifikasie-lys te skuif, is streng verbode.

SMALLS NOTICE

Kuruman Scrapyard

Vakature: Algemene Kantoordame onmiddellik beskikbaar

Vaardighede:
Rekenaar: Microsoft Office en IQ 2000
Kantoorpligte: Krediteure, debiteure, boekhouding en algemene kantoor- pligte.

Ideale persoon is 'n vriendelike, nie-roker wat onafhanklik kan werk, met sober gewoontes.

Goeie kennis in boekhouding en IQ 2000 sal as aanbeveling dien.

Handig CV in by Kuruman Scrapyard of faks 053 712 1630 of tel. 053 712 1631.

TRENT & JEPPE REKENMEESTERS

BENODIG DIE DIENSTE VAN 'N PERSOON MET ONDERVINDING IN DIE VOLGENDE:

- PASTEL-BANKREKONSILIASIES
- E-FILING
- PASTEL PAYROLL
- CIPC OPGAWES

BELANGSTELLENDES FAKS 'N CV NA 086 698 9707.

INDIEN U NIE VOOR/OP 25 MEI 2012 TERUGVOERING ONTVANG NIE, WAS U AANSOEK ONSUKSESVOL.

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Kalahari Bulletin

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GCS WATER • ENVIRONMENTAL • EARTH SCIENCES • GIS

NOTIFICATION OF AN ENVIRONMENTAL AUTHORISATION PROCESSES IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998) / MINERAL AND PETROLEUM RESOURCE DEVELOPMENT ACT (ACT NO. 28 OF 2002) / NATIONAL WATER ACT (ACT NO. 36 OF 1998) FOR THE PROPOSED NEW MAIN STREET 778 (PTY) LTD UNDERGROUND MANAGENESE MINE NEAR HOTAZEL IN THE NORTHERN CAPE PROVINCE

DEPARTMENT OF MINERAL RESOURCES: REFERENCE NUMBER: NC30/5/1/1/2/10014MR / NORTHERN CAPE DEPARTMENT OF ENVIRONMENT AND NATURE CONSERVATION REFERENCE NUMBER: NC/EIA/JTG/MOSH/HOT2012 / GCS REFERENCE NO: 12-105

Notice is hereby given of the Environmental Impact Assessment (EIA) process, the Mining Right Application (MRA) process and the Integrated Water Use License Application (IWULA) process to be undertaken by GCS (Pty) Ltd on behalf of Main Street 778 (Pty) Ltd for a proposed new manganese mine (Mukulu Project) near Hotazel, Northern Cape Province. The Mukulu Project is located approximately 8 km to the west of Hotazel and lies adjacent (to the west of) the existing Assmang Manganese Black Rock Mine. The Mukulu Project MRA area is located across seven (7) farms: Mukulu 265, Santoy 230, Belgravia 264, Olive Wood 282, Tigerpan 266, Bergheim 229 and Epsom 285. Three mineral resource blocks have been identified: the first is on Mukulu, the second across Olive Wood, Espom and Tigerpan, and the third on Santoy and Belgravia. The estimated life of mine is 29 years.

The following authorisations are required:

* **Mining Right in terms of section 23 of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act No. 28 of 2002);**
* **Environmental Authorisation for the following activities listed in terms of section 24 (2) the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998);**

The NEMA activities which are triggered by the proposed mine are listed under Regulations R544 and R545, and as such require an application for an Environmental Authorisation in the form of an EIA process. All activities under Notice 1 GN 544 which requires a Basic Assessment will be included as part of the full EIA process.

R 544 (9): The construction of facilities or infrastructure exceeding 1000 m in length for the bulk transport of water, sewage or storm water –
i) with an internal diameter of 0,36 metres or more; or
ii) with a peak throughput of 120 litres per second or more, excluding where:
a) such facilities or infrastructure are for bulk transport of water, sewage or storm water or storm water drainage inside a road reserve; or
b) where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.

R 544 (12): The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010.

R 544 (13): The construction of facilities or infrastructure for the storage, or for the storage and handling, of dangerous goods, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.

R 544 (22): The construction of a road, outside urban areas -
i) With a reserve wider then 13,5 meters or
ii) Where no reserve exists where the road is wider than 8 metres or
iii) For which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 f 2006 or activity 18 in Notice 545 of 2010.

R 544 (47): The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre -
i) Where the existing reserve is wider than 13,5 meters or
ii) Where no reserve exists, where the existing road is wider than 8 metres, excluding widening or lengthening occurring inside urban areas.

R 544 (53): The expansion of railway lines, stations or shunting yards where there will be an increased development footprint – excluding:
i) Railway lines, shunting yards and railway stations in industrial complexes or zones;
ii) Underground railway lines in mines and
iii) Additional railway lines within the reserve of an existing railway line.

R 545 (15): Physical alteration of undeveloped vacant or derelict land for residential retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more, except where such physical alteration takes place for:
i) Linear development activities or
ii) Agriculture or afforestation where activity 16 in this Schedule will apply.

R 545 (20): Any activity which requires a mining right or renewal thereof as contemplated in section 22 and 24 respectively of the MPRDA. [Date of commencement of Activity 20: to be proclaimed].

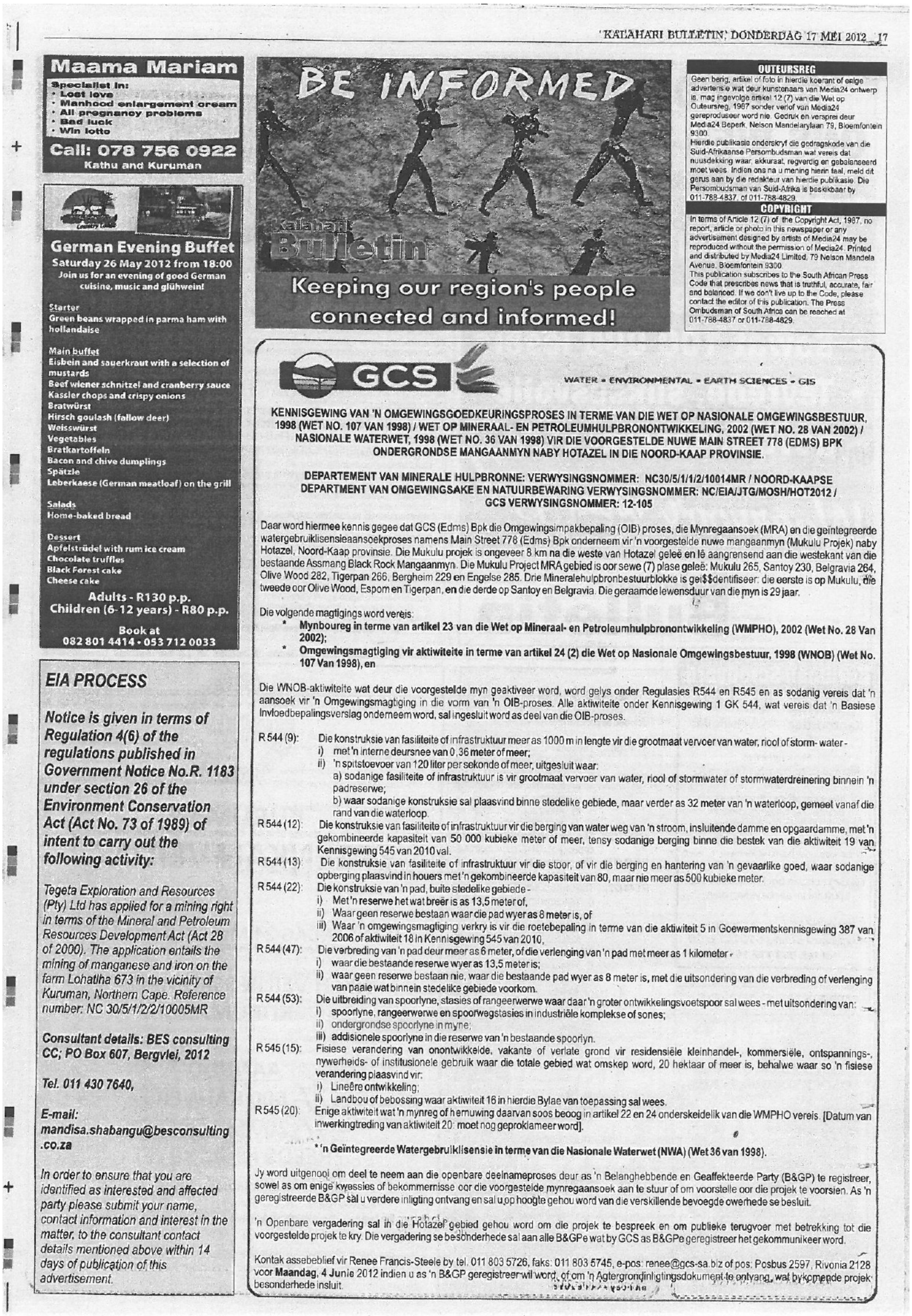
* **Integrated Water Use License in terms of the National Water Act (NWA) (Act No. 36 of 1998).**

You are invited to participate in the stakeholder engagement process by registering as an Interested and Affected Party (I&AP) as well as to raise any issues or concerns about the proposed environmental authorisation applications or to submit suggestions regarding the project. As a registered I&AP, you will receive further information and will be kept informed of the decisions taken by the competent authorities.

A public meeting will be held in the Hotazel area to discuss the project and obtain feedback from the public with regards to the proposed project. Details of the meeting will be communicated to all I&APs who have registered as I&APs with GCS.

Should you wish to register as an I&AP or to receive a background information document, with additional details on the project, please contact Renee Francis-Steele by tel. 011 803 5726 or fax: 011 803 5745, e-mail: renee@gcs-sa.biz or post: PO Box 2597, Rivonia 2128 before **Monday, 4 June 2012.**

Figure 5.2 Advertisement (English) in Kalahari Bulletin (17 May 2012)



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EIA PROCESS

Notice is given in terms of Regulation 4(6) of the regulations published in Government Notice No.R. 1183 under section 26 of the Environment Conservation Act (Act No. 73 of 1989) of intent to carry out the following activity:

Tegeta Exploration and Resources (Pty) Ltd has applied for a mining right in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2000). The application entails the mining of manganese and iron on the farm Lohatlha 673 in the vicinity of Kuruman, Northern Cape. Reference number: NC 30/5/1/2/2/10005MR

Consultant details: BES consulting CC; PO Box 607, Bergvlei, 2012

Tel. 011 430 7640,

E-mail: mandisa.shabangu@besconsulting.co.za

In order to ensure that you are identified as interested and affected party please submit your name, contact information and interest in the matter, to the consultant contact details mentioned above within 14 days of publication of this advertisement.

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Kalahari Bulletin

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Geen berig, artikel of foto in hierdie koerant of enige advertensie wat deur kunstenaars van Media24 ontwerp is, mag ingevolge artikel 12 (7) van die Wet op Outeursreg, 1987 sonder verlof van Media24 gereproduseer word nie. Gedruk en versprei deur Media24 Beperk, Nelson Mandelarylaan 79, Bloemfontein 9300.

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GCS

WATER • ENVIRONMENTAL • EARTH SCIENCES • GIS

KENNISGEWING VAN 'N OMGEWINGSGOEDKEURINGSPROSES IN TERME VAN DIE WET OP NASIONALE OMGEWINGSBESTUUR, 1998 (WET NO. 107 VAN 1998) / WET OP MINERAAL- EN PETROLEUMHULPBRONONTWIKKELING, 2002 (WET NO. 28 VAN 2002) / NASIONALE WATERWET, 1998 (WET NO. 36 VAN 1998) VIR DIE VOORGESTELDE NUWE MAIN STREET 778 (EDMS) BPK ONDERGRONDSE MANGAANMYN NABY HOTAZEL IN DIE NOORD-KAAP PROVINSIE.

DEPARTEMENT VAN MINERALE HULPBRONNE: VERWYSINGSNOMMER: NC30/5/1/1/2/10014MR / NOORD-KAAPSE DEPARTMENT VAN OMGEWINGSAKE EN NATUURBEWARING VERWYSINGSNOMMER: NC/EIA/JTG/MOSH/HOT2012 / GCS VERWYSINGSNOMMER: 12-105

Daar word hiermee kennis gegee dat GCS (Edms) Bpk die Omgewingsimpakbepaling (OIB) proses, die Mynregaansoek (MRA) en die geïntegreerde watergebruiklisensieaansoekproses namens Main Street 778 (Edms) Bpk onderneem vir 'n voorgestelde nuwe mangaanmyn (Mukulu Projek) naby Hotazel, Noord-Kaap provinsie. Die Mukulu projek is ongeveer 8 km na die weste van Hotazel geleë en lê aangrensend aan die westekant van die bestaande Assmang Black Rock Mangaanmyn. Die Mukulu Project MRA gebied is oor sewe (7) plase geleë: Mukulu 265, Santoy 230, Belgravia 264, Olive Wood 282, Tigerpan 266, Bergheim 229 en Engelse 285. Drie Mineralehulpbronbestuurblokke is gei$$dentifiseer: die eerste is op Mukulu, die tweede oor Olive Wood, Espom en Tigerpan, en die derde op Santoy en Belgravia. Die geraamde lewensduur van die myn is 29 jaar.

Die volgende magtigings word vereis:

- **Mynboureg in terme van artikel 23 van die Wet op Mineraal- en Petroleumhulpbronontwikkeling (WMPHO), 2002 (Wet No. 28 Van 2002);**
- **Omgewingsmagtiging vir aktiwiteite in terme van artikel 24 (2) die Wet op Nasionale Omgewingsbestuur, 1998 (WNOB) (Wet No. 107 Van 1998), en**

Die WNOB-aktiwiteite wat deur die voorgestelde myn geaktiveer word, word gelys onder Regulasies R544 en R545 en as sodanig vereis dat 'n aansoek vir 'n Omgewingsmagtiging in die vorm van 'n OIB-proses. Alle aktiwiteite onder Kennisgewing 1 GK 544, wat vereis dat 'n Basiese Invloedbepalingsverslag onderneem word, sal ingesluit word as deel van die OIB-proses.

R 544 (9): Die konstruksie van fasiliteite of infrastruktuur meer as 1000 m in lengte vir die grootmaat vervoer van water, riool of storm- water -
i) met 'n interne deursnee van 0,36 meter of meer;
ii) 'n spitstoevoer van 120 liter per sekonde of meer, uitgesluit waar:
a) sodanige fasiliteite of infrastruktuur is vir grootmaat vervoer van water, riool of stormwater of stormwaterdreinering binnein 'n padreserwe;
b) waar sodanige konstruksie sal plaasvind binne stedelike gebiede, maar verder as 32 meter van 'n waterloop, gemeet vanaf die rand van die waterloop.

R 544 (12): Die konstruksie van fasiliteite of infrastruktuur vir die berging van water weg van 'n stroom, insluitende damme en opgaardamme, met 'n gekombineerde kapasiteit van 50 000 kubieke meter of meer, tensy sodanige berging binne die bestek van die aktiwiteit 19 van Kennisgewing 545 van 2010 val.

R 544 (13): Die konstruksie van fasiliteite of infrastruktuur vir die stoor, of vir die berging en hantering van 'n gevaarlike goed, waar sodanige opberging plaasvind in houers met 'n gekombineerde kapasiteit van 80, maar nie meer as 500 kubieke meter.

R 544 (22): Die konstruksie van 'n pad, buite stedelike gebiede -
i) Met 'n reserwe het wat breër is as 13,5 meter of,
ii) Waar geen reserwe bestaan waar die pad wyer as 8 meter is, of
iii) Waar 'n omgewingsmagtiging verkry is vir die roetebepaling in terme van die aktiwiteit 5 in Goewermentskennisgewing 387 van 2006 of aktiwiteit 18 in Kennisgewing 545 van 2010,

R 544 (47): Die verbreding van 'n pad deur meer as 6 meter, of die verlenging van 'n pad met meer as 1 kilometer -
i) waar die bestaande reserwe wyer as 13,5 meter is;
ii) waar geen reserwe bestaan nie, waar die bestaande pad wyer as 8 meter is, met die uitsondering van die verbreding of verlenging van paaie wat binnein stedelike gebiede voorkom.

R 544 (53): Die uitbreiding van spoorlyne, stasies of rangeerwerwe waar daar 'n groter ontwikkelingsvoetspoor sal wees - met uitsondering van:
i) spoorlyne, rangeerwerwe en spoorwegstasies in industriële komplekse of sones;
ii) ondergrondse spoorlyne in myne;
iii) addisionele spoorlyne in die reserwe van 'n bestaande spoorlyn.

R 545 (15): Fisiese verandering van onontwikkelde, vakante of verlate grond vir residensiële kleinhandel-, kommersiële, ontspannings-, nywerheids- of institusionele gebruik waar die totale gebied wat omskep word, 20 hektaar of meer is, behalwe waar so 'n fisiese verandering plaasvind vir:
i) Lineêre ontwikkeling;
ii) Landbou of bebossing waar aktiwiteit 16 in hierdie Bylae van toepassing sal wees.

R 545 (20): Enige aktiwiteit wat 'n mynreg of hernuwing daarvan soos beoog in artikel 22 en 24 onderskeidelik van die WMPHO vereis. [Datum van inwerkingtreding van aktiwiteit 20: moet nog geproklameer word].

*** 'n Geïntegreerde Watergebruiklisensie in terme van die Nasionale Waterwet (NWA) (Wet 36 van 1998).**

Jy word uitgenooi om deel te neem aan die openbare deelnameproses deur as 'n Belanghebbende en Geaffekteerde Party (B&GP) te registreer, sowel as om enige kwessies of bekommernisse oor die voorgestelde mynregaansoek aan te stuur of om voorstelle oor die projek te voorsien. As 'n geregistreerde B&GP sal u verdere inligting ontvang en sal u op hoogte gehou word van die verskillende bevoegde owerhede se besluit.

'n Openbare vergadering sal in die Hotazel gebied gehou word om die projek te bespreek en om publieke terugvoer met betrekking tot die voorgestelde projek te kry. Die vergadering se besonderhede sal aan alle B&GPe wat by GCS as B&GPe geregistreer het gekommunikeer word.

Kontak assebeblief vir Renee Francis-Steele by tel. 011 803 5726, faks: 011 803 5745, e-pos: renee@gcs-sa.biz of pos: Posbus 2597, Rivonia 2128 voor **Maandag, 4 Junie** 2012 indien u as 'n B&GP geregistreer wil word, of om 'n Agtergrondinligtingsdokument te ontvang, wat bykomende projek besonderhede insluit.

Figure 5.3 Advertisement (Afrikaans) in Kalahari Bulletin (17 May 2012)

5.3.3 Background Information Documents (BIDs)

Background Information Document (BID), compiled in English and Afrikaans, were distributed via email, fax and post to the following people listed on the Mukulu Mine stakeholder database:

- Landowners of the properties within the proposed Mukulu Mine MRA;
- The members of the Agri Kuruman group. This is a farmers group within the Hotazel and Kuruman area. The database for the group was provided by the chairman of the group, Mr. Jan Theart;
- Local, provincial and national authorities;
- Representatives of Transnet and Eskom;
- All I&APs who contacted GCS following the placement of the advertisement in the Kalahari Bulletin on 17 May 2012; and
- BIDs (including registration forms) were placed on the table underneath the site notice at the Hotazel Library and Arts and Culture Centre.

5.4 Public Meetings

5.4.1 Landowner Consultation Meetings

Assmang Ltd

A consultation meeting was held on 10 May 2012 between Mr. Bava Reddy on behalf of Main Street and the representatives of Assmang Black Rock, which is the lawful landowner of the farms Mukulu 265, Belgravia 264, Portion 1 of Santoy 231, and Bergheim 229. There is no record of the discussions, so the issues which arose from this meeting have not been included in this report.

The immediate results of these discussions was a land use agreement which allowed for the specialist studies to be undertaken on the Assmang owned properties within the proposed Mukulu Mine MRA (Refer to Appendix C).

Landowner Consultation Meeting

A landowner consultation meeting was held with the landowners of the farms Epsom 285, Santoy 230 (Portion 0), and Olivewood 280. The owner of the farm Tigerpan186 lives in the Western Cape Province and was unable to attend.

The meeting was held at the Kalahari Cottage Guest Lodge in Hotazel on Thursday, 10 May 2012 at 13:00pm.

The landowners were informed, in writing, of the meeting date, time and venue via email (Refer to Appendix C).

Each attendee received an information pack which included:

- A3 map indicating the locality and extent of the proposed Mukulu Mine MRA;
- A4 map showing the property name and number and the name of each property owner identified;
- Information pamphlet containing the background information, the environmental authorization applications being undertaken and the contact details of the EAP; and
- Registration and comment sheet and a pen.

The signed attendance register and the minutes of the meeting are attached Appendix C. The issues raised during this meeting are summarized under the issues and response section of this report (Refer to Section 5.2.4).

5.4.2 Introductory Public Meeting

An introductory public meeting will be arranged during the scoping phase of the NEMA application process. All registered I&APs will be informed, in writing, of the public meeting. This includes the landowners within the Mukulu Mine MRA, members of Agri-Kuruman, local, provincial and national authorities, and all people who register as I&APs.

The public documents which were distributed (site notices, advertisement and BIDs) stated that the date for the public meeting will be communicated in writing to all registered I&APs.

An Environmental Scoping Report (ESR) will be compiled in terms of NEMA and this report will be made available for public comment at least two (2) weeks prior to the public meeting (Refer to Section 5.4.4 of this report). All registered I&APs will be informed of the availability of this report.

5.4.3 Specialist Feedback

A public specialist feedback meeting will be held during the EIA phase of the NEMA application process. This will be held at least two (2) weeks after making the EIA and EMP reports available for public review (Refer to Section 5.4.4).

All registered I&APs will be informed, in writing, of the public meeting.

5.5 Stakeholder Database

A stakeholder database was developed for the project (Refer to Appendix C). The database contains the contact details of the landowners, members of the Agri-Kuruman group, local, provincial and national authorities as well as all people who requested registration.

Although the deadline for registrations given in all the public documents distributed (site notice, BID and advert) was Monday, 4 June 2012, I&APs will continue to be registered throughout the project. The deadline of 4 June was to allow for the compilation of this EIA/EMP document.

5.6 Issues and Responses

The issues raised during the landowner consultation meeting and during the registration period (Thursday, 17 May 2012 to Monday, 4 June 2012) are summarized in Table 5.1.

Table 5.1 Issues and Response for Mukulu Mine Stakeholder Engagement Process

ISSUE/COMMENT/SUGGESTION	RAISED BY	DATE AND WHERE	RESPONSE	REFERENCE
Is this meeting [landowner consultation meeting on Thursday, 10 May 2012], a meeting in terms of the required public participation process.	Jan Theart	10 May 2012, Landowner Consultation Meeting	The meeting is introductory and provides the landowners with the opportunity to communicate with the applicant directly and to ask questions regarding the proposed project. The meetings in terms of the formal public participation process will still be held, once the specialist studies have been completed.	Section 5.4
How long the Mining Right Application will be granted for?	I&AP	10 May 2012, Landowner Consultation Meeting	The first Prospecting Right Application was made for a 5 year period, after which was extended for 3 years and expired in December 2011. Main Street therefore applied for a Mining Right for the maximum period of 30 years. The proposed mine plan will allow for the mine to start development of a shaft on Mukulu farm, after which shafts will be developed on other farms, after the 30 year period.	Section 3.3.5
What will the process of negotiation be between the proposed mine and the surface right owners?	Jan Theart	10 May 2012, Landowner Consultation Meeting	Main Street will only have rights to the mineral resource, and not surface rights. Therefore the company will draw up a formal agreement with the surface right owners. The agreement will contain measures on how rehabilitation will be done.	Section 1.4
The dispute [landowners restricting access to farms] occurred due to specialists who went to site.	Jan Theart	10 May 2012, Landowner Consultation Meeting	Mr. Bava Reddy apologised and stated that a meeting should have been arranged between Main Street and the surface right owners sooner.	Section 5.4.1
There are certain procedures that have to followed, due to the times we live in it is distressing when one notices a strange vehicle on your property.	Jan Theart	10 May 2012, Landowner Consultation Meeting	Comment Noted.	N/A

ISSUE/COMMENT/SUGGESTION	RAISED BY	DATE AND WHERE	RESPONSE	REFERENCE
No one from Assmang is present at the landowner meeting. Have they been consulted?	Jan Theart	10 May 2012, Landowner Consultation Meeting	Mr. Francois Uys from Assmang have been consulted with and Assmang is aware of the proposed project. Main Street has a Land Use Agreement with Assmang for Mukulu farm. Bava Reddy showed the attendees the Land Use Agreement, and stated that such a document will be compiled with each of the Surface Right Owners.	Appendix C
Kgalagadi took his Prospecting and Mining Rights away from I&AP, and he is fighting for his daughters' future.	I&AP	10 May 2012, Landowner Consultation Meeting	Such issues need to be taken up with the DMR.	N/A
Is there an agreement in place with BHP Billiton or Assmang with regards to using the railways?	Jan Theart	10 May 2012, Landowner Consultation Meeting	Main Street have had preliminary discussions regarding linking up with the existing railway lines. Transnet may take over the railway lines currently under ownership of BHP Billiton and Assmang, and Main Street will tap into this line.	Section 3.5 and 4.1
If it is not possible for Main Street to make use of the railway line in question, will they construct their own railway line, or link up with the Kgalagadi project?	Johan Lamprecht	10 May 2012, Landowner Consultation Meeting	Main Street will not link up with the Kgalagadi line, as they have and enough discussions with Assmang on the matter	Section 3.5 and 4.1
Is road transport is an option?	Jan Theart	10 May 2012, Landowner Consultation Meeting	It is not feasible for Main Street utilize road transportation of the product, as Main Street will produce 2Million tonnes per annum, and transport costs per truck and road amounts to approximately R400 per tonne compared to R150 per tonne per rail.	Section 4.1
Will Eskom provide power supply to the mine?	Jan Theart	10 May 2012, Landowner Consultation Meeting	Eskom is busy with a 120kV line from Kukulu to Klipkop, and it is the intention of Main Street to apply to link up to this new line.	Section 3.9

ISSUE/COMMENT/SUGGESTION	RAISED BY	DATE AND WHERE	RESPONSE	REFERENCE
Does Eskom have capacity to provide the mine with power?	Jan Theart	10 May 2012, Landowner Consultation Meeting	Eskom is proposing 2 new power stations to be on line by 2015. Main Street will also need 2 years construction before it reaches its peak power by 2017. It is therefore envisaged that Eskom will have capacity for the project.	N/A
Will water monitoring will be conducted around the planned infrastructure development or will it extend to neighbouring farm portions.	Jan Theart	10 May 2012, Landowner Consultation Meeting	The boreholes used to determine the baseline water quality will be monitored. The mine must monitor wider than only around proposed infrastructure.	Section 8
The neighbouring mines should also monitor, and mentioned Aquila Mine.	Jan Theart	10 May 2012, Landowner Consultation Meeting	Noted	Section 8
Before someone enters the property they have to arrange beforehand.	Jan Theart (Senior)	10 May 2012, Landowner Consultation Meeting	The specialists will be contacted, and their methodologies for conducting their specialist studies will be provided to the client.	N/A
Will the mine utilise underground water resources, or if the Vaal-Gamagara pipeline be used as it is already severely under pressure.	Jan Theart	10 May 2012, Landowner Consultation Meeting	Main Street doesn't know at this stage and still has to clarify sources of water. Assmang indicated that they are currently experiencing water shortages. Preliminary discussions with the Department of Water Affairs stated that they may be accommodated.	Section 3.8.1
A water user forum has been established and that they are meeting later in the week. The chair of the water user forum is DWA. Water availability is currently a major problem as the town is also expanding. DWA is busy with a study to use underground water resources, but the public is not in favour of this option. A new pipeline has to be constructed to provide water.	Jan Theart	10 May 2012, Landowner Consultation Meeting	If a new pipeline has to be constructed, it will make sense that the mining companies provide funds for construction of the pipeline, and share the costs with the municipality.	Section 4.1
Kgalagadi mine will start operations soon, and there are a lot of farmers and mine who depend on the water from the pipeline.	Jan Theart	10 May 2012, Landowner Consultation Meeting	Comment Noted	N/A

ISSUE/COMMENT/SUGGESTION	RAISED BY	DATE AND WHERE	RESPONSE	REFERENCE
What type of agriculture is taking place on the farms in the surrounding area?	Jessica de Beer (GCS)	10 May 2012, Landowner Consultation Meeting	Jan Theart stated that it is mostly cattle and that the farmers are dependent on the groundwater resources.	Section 2.4.2
The current water table is at 49m, if the mine will extract resources 300 – 400m below the surface, their water and subsequently their livelihood will disappear.	Jan Theart (Senior)	10 May 2012, Landowner Consultation Meeting	Comment Noted	Section 2.10 and 3.3.5
The cumulative impacts on the water table must be looked at.	Jan Theart	10 May 2012, Landowner Consultation Meeting	Comment Noted	Section 2.10 and 3.3.5
It was mentioned that there currently is not enough housing, and where will the workforce be accommodated?	Jan Theart	10 May 2012, Landowner Consultation Meeting	It is Main Street's intention to let their workforce stay in Kuruman or Kathu, and bus them to and from work on a daily basis.	Section 3.13
A recent court ruling necessitates that the municipality rezone the area to mining. Will Main Street will do such a rezoning application.	Jan Theart	10 May 2012, Landowner Consultation Meeting	It is a legal requirement, and Main Street has to comply with the law. GCS has not been appointed to assist in the rezoning application, but Main Street will apply for this.	Section 12
Will contractors stay on the mine site during the construction phase of the project?	Jan Theart	10 May 2012, Landowner Consultation Meeting	The current land use agreement with Assmang does not allow for people to stay over, therefore the construction team will have to be transported in and out.	N/A
Will the mine definitely go forward?	Jan Theart	10 May 2012, Landowner Consultation Meeting	The Mining Works Programme and the Social and Labour Plan as well as the Environmental Impact Assessment and Management Plan (EIA/EMP) need to be approved by the DMR before any construction activity can take place. Bava Reddy stated that Main Street is continuing with drilling activities until 2017 to complete their bankable feasibility study.	Section 1.5

ISSUE/COMMENT/SUGGESTION	RAISED BY	DATE AND WHERE	RESPONSE	REFERENCE
			Approval for the project is required for the Mining Right by the Department of Mineral Resources (DMR), as well as an application for listed activities in terms of the National Environmental Management Act (NEMA), and municipal rezoning before construction activities may start. In addition to these applications, the mine also requires a Water Use License (WUL) in terms of the NWA from the DWA before they may start to operate.	
If the authorisation process goes past 2015 if the project will still go ahead?	Jan Theart	10 May 2012, Landowner Consultation Meeting	Main Street will go ahead with the bankable feasibility study before they will know for sure.	Section 1.5
Can the mine start construction without a WULA?	Jan Theart	10 May 2012, Landowner Consultation Meeting	Construction activities may proceed without a WULA, but no operational activities may commence. No construction activities will commence without the WULA being granted by DWA first. New mines get all their authorisations first.	Section 1.5
Interested in becoming a supplier for the project	Marius Kuhn	Email, 17 May 2012	Bid and registration form forwarded to Marius. Details registered on the stakeholder database	Appendix C
Eskom has a concern that additional electrical capacity, or overhead lines and substations, are not listed. Eskom need an indication of whether the applicant will need electricity, how much and by when. The EIA for a line route can take up to 18 months.	Attie du Toit	Email, 18 May 2012	BID was forward via email. At this stage, it is anticipated that the mine reticulation will be provided at 11kv, with a main substation to be situated on Mukulu 265 (see locality map attached). A powerline is also proposed on the property.	Section 3.9

ISSUE/COMMENT/SUGGESTION	RAISED BY	DATE AND WHERE	RESPONSE	REFERENCE
A new powerline is being constructed to Hotazel area. Eskom would like an indication sooner to factor in the requirement for Mukulu. Once the line is built it will be too late to address any other electricity applications. The applicant must apply for electricity now. The application can be sent to me.	Attie du Toit	Email, 18 May 2012	Email from Attie du Toit forwarded to Mr. Bava Reddy at Atlasa (on behalf of Main Street).	Section 3.9
Application for electrical capacity from Eskom must be made.	Attie du Toit	Registration form 22 May 2012	Comment Noted	Section 3.9
Groundwater resources should be maintained	J.J.F. Theart	Registration form, 22 May 2012	Comment Noted	Section 2.10 and 7.4
Concern about the impacts of mining on the groundwater and the water abstracted for livestock watering.	H.J. Lamprecht	Registration form, 22 May 2012	Comment Noted. [Dewatering will occur, however the impact from the exploitation of the Mukulu orebody is not expected to be of high significance]	Section 2.10 and 7.4
Roads to the farm Santoy and Bergheim cannot manage high traffic levels	H.J. Lamprecht	Registration form, 22 May 2012	Comment Noted. [Rail transport is preferred for ore transport. Road impacts are expected to be confined to the transport of employees to and from the mine, as well as suppliers vehicles]	Section 2.14 and 7.4.7
Water is a very important resources in the area used for livestock.	C. du Plessis	Registration form, 25 May 2012	Comment Noted	Section 2.10 and 7.4
The access roads to Santoy and Bergheim are not suitable for heavy exploration vehicles.	C. du Plessis	Registration form, 25 May 2012	Comment Noted	Section 2.14 and 7.4.7
Water levels of the boreholes on neighbouring properties should be measured before exploration boreholes are drilled and should be monitored regularly thereafter.	C. du Plessis	Registration form, 25 May 2012	Comment Noted	Section 2.10 and 7.4

5.7 Document Review

Due to the timeframes for the MRA application in terms of the MPRDA, there was insufficient time to make the EMP report available for public review. The report will, however, be uploaded on the GCS website from Friday, 15 June 2012 for download and review. Copies of the EMP will be posted to all landowners, as well as any other I&APs who request it.

The reports compiled in terms of NEMA and NWA will, however, will be made available for public review at the Hotazel Public Library and Arts & Culture Centre. Copies of the report will be sent on CD to the landowners, as requested during the landowner consultation meeting on 10 May 2012. The following reports will be made available for public review and comment prior to being submitted to the competent authority:

- Environmental Scoping Report (ESR) compiled in terms of NEMA. This report will be made available for public review at the Hotazel Public Library;
- Environmental Impact Assessment Report and Environmental management Programme Reports compiled in terms of NEMA; and
- Integrated Water Use License Application (IWUL) and integrated Waste Water Management Plan (IWWMP).

6 ENVIRONMENTAL MANAGEMENT GOALS AND OBJECTIVES

This chapter of the EIA/EMP report relates to Section 51 (a) (ii) of the MPRDA Regulation 527 and Section 2- 2 of the EMP Template:

- *(Section 2 – 2): Description of environmental objectives and specific goals for the management of identified environmental impacts emanating from the proposed mining operation. (As informed by the information provided in the EIA in terms of Regulation 50 (h)).*

6.1 Activities

Before the potential environmental impacts posed by the proposed Mukulu Mine may be identified, the activities associated with the establishment, operation and decommissioning of the proposed mine must be identified.

The proposed infrastructure for the mine is described in detail in chapter 3 of this EIA/EMP report. The activities required to establish, operate and decommission the mine are described in the sections which follow.

The main activities which will create impacts during the different phases of the mine life cycle were assessed during the EIA and mitigation and management measures developed thereto (Refer to Chapter 7 of this document). The main activities are summarised in Figure 6.1.

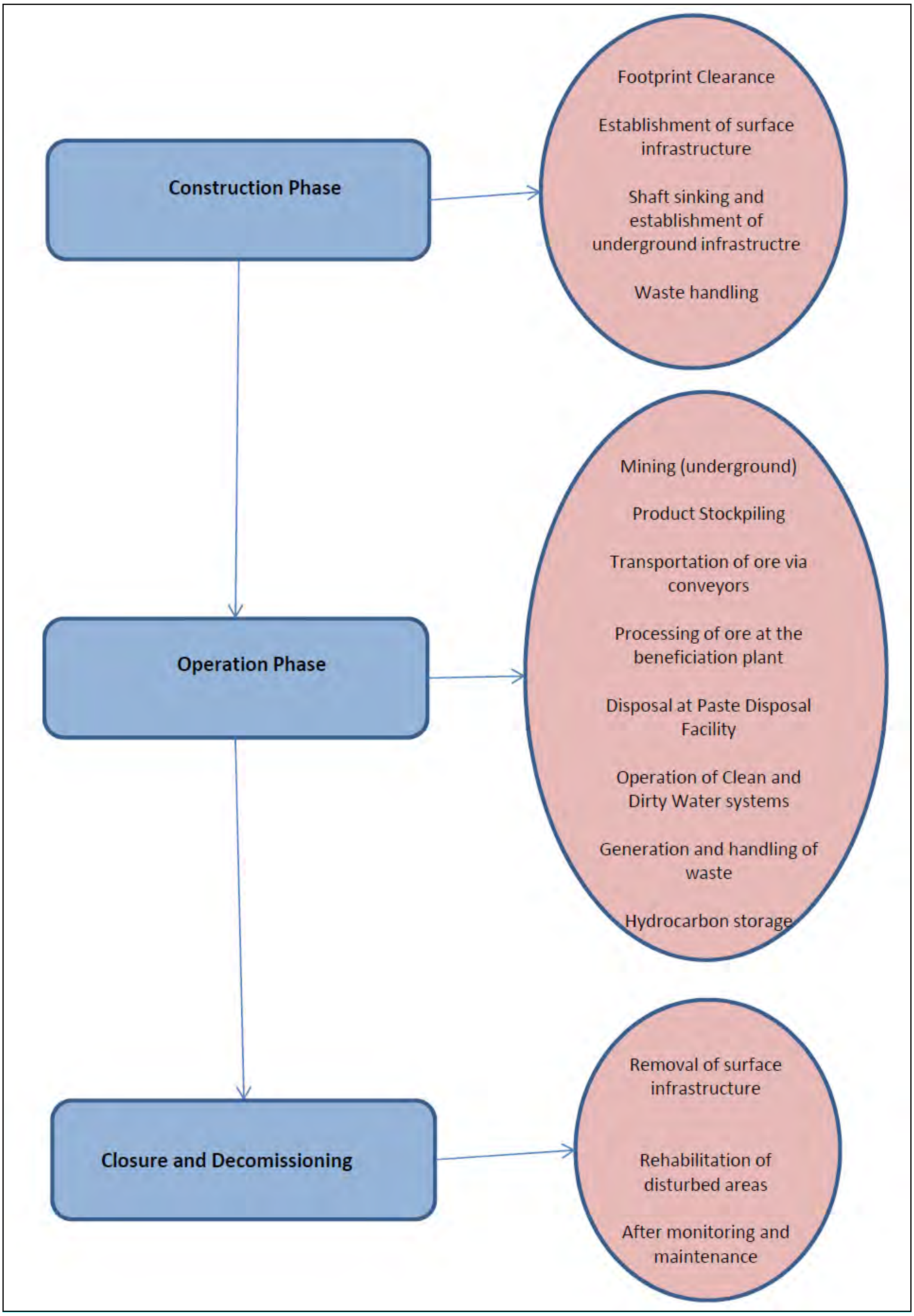


Figure 6.1 Proposed activities for the Mukulu Mine life cycle

6.1.1 Construction

The construction phase will be undertaken over a two (2) year period and will involve:

- Footprint Clearance:
  - Removal of vegetation;
  - Topsoil stripping and stockpiling;
  - Leveling the area (and/or terracing in steeper sections of the infrastructure area);
  - The movement of vehicles on site, and on regional road;
- Establishment of surface infrastructure;
  - Establishment of contractor's laydown area;
  - Fencing of construction area;
  - Construction of haul roads, powerlines and water pipelines;
  - Construction of offices, workshops and changehouse;
  - Construction of storm water management infrastructure (channels, berms and pollution control dams);
  - Management and disposal of domestic and hazardous waste generated during the construction phase;;
  - Construction conveyor from Mukulu Shaft to ROM stockpile (conveyors from the other shafts to be constructed during the operational phase, before each shaft is phased in);
- Shaft sinking and establishment of underground infrastructure; and
- Waste Handling.
  - Domestic and construction waste generation;
  - Waste storage;
  - Movement of vehicles on site to storage facilities; and
  - Diesel storage for construction activities.

6.1.2 Operation

The total life of mine for the proposed Mukulu Mine will be 29 years. The operation of the mine will include the following activities (described in detail under Chapter 3 of this report):

- Mining (underground);
- Product Stockpiling;
- Transportation of ore via conveyors;
- Processing of ore at the beneficiation plant;
- Disposal at Paste Disposal Facility;
- Operation of Clean and Dirty Water systems;
- Generation and handling of waste (mine waste rock, domestic, hazardous, and sewage);
- Hydrocarbon storage;
- Transport of equipment and employees onto and off site;
- Loading of ore, etc. onto trains; and
- Additional topsoil stripping, handling and stockpiling as the mining operations expand.

6.1.3 Closure and Decommissioning

The following activities will be conducted in the closure phase:

- Removal of surface infrastructure and removing the gravel surface of haul roads;
- Removal of building rubble (from demolished infrastructure) for disposal at a suitably licensed waste disposal facility;
- Rehabilitation of disturbed areas:
  - Ripping of soils to reduce compaction;
  - Applying topsoil and gravel mixture to areas which are to be rehabilitated;
  - Re-vegetation disturbed areas; and
- After monitoring and maintenance of rehabilitated areas (to ensure that rehabilitation is successful).

6.2 Environmental Management Objectives

6.2.1 Construction Phase

6.2.1.1 Footprint Clearance

The environmental objectives associated with footprint clearance and removal of vegetation for construction purposes are:

- To limit activities to the indicated and approved areas to ensure that no new additional land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;
- Removal of weeds and other invasive species over the Mukulu mining area;
- To prevent any cumulative impact associated with the removal of vegetation and footprint clearance;
- To reduce the dust dispersion as a result of the removal of earth material as far as possible;
- To ensure an effective surface run-off control system is in order from the commissioning of the construction activities to deal with the separation of clean and dirty water;
- To remain outside of any delineated no-go zones (such as pans);
- To ensure that the necessary approvals are in-place should any red-data or protected species be relocated or removed;
- To strictly manage the activities taking place within the lay down area by implementing clear and effective ground rules; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.1.2 Establishment of Infrastructure

The environmental objectives associated with the establishment of infrastructure associated with this project are:

- To remain within the approved project scope and area; take care that no new land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;
- To ensure that the area over which the infrastructure will be placed is stable;
- To ensure that the placement of infrastructure will not sterilize any potential future mining reserves;

- To prevent any cumulative impact associated with the removal of vegetation and topsoil;
- To reduce the noise associated with the construction and operational activities as far as possible;
- To manage any other nuisance which may occur as a result of the establishment of new infrastructure;
- To manage the influx of people seeking work and the potential for informal establishment and associated petty crimes;
- To accommodate the use of natural material and colours where possible to reduce the potential visual impact on the surrounding area; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.1.3 Shaft sinking and establishment of underground infrastructure

The environmental objectives associated with the establishment of infrastructure associated with this project are:

- To ensure that the minimum surface area is disturbed during the development of the access and ventilation shafts;
- To prevent any cumulative impact associated with the removal of vegetation and topsoil; and
- To reduce the noise associated with the construction and operational activities as far as possible.

6.2.1.4 Waste handling

The objectives for waste generation and handling of domestic, diesel and chemical storage are to:

- Ensure that storage takes place in such a manner as not to cause any pollution to the environment;
- Ensure that storage facilities comply with best practice guidelines;
- Prevent any pollution of water resources by ensuring that an effective surface runoff control system is in place;
- Prevent, contain and clean up any spillages during the life of the mine; and
- Ensure that all facilities are monitored on a regular basis.

6.2.2 Operational phase

6.2.2.1 Mining (underground)

The objectives associated with mining are:

- To ensure that health and safety procedures are followed;
- To have an open channel of communication with the surrounding land owners to ensure that all the needs of parties are adhered to as far as practically possible; and
- To achieve overall legal compliance.

6.2.2.2 Product Stockpiling

The environmental objectives associated with the product stockpiling and transportation is:

- To contain the stockpiles in order to reduce the alienation of land;
- To utilise existing road systems as far as practically possible to serve as service roads;
- To implement measures as part of the management programme to reduce any potential impact on rare or endangered species;
- To prevent any cumulative impact associated with the transportation of ore;
- To prevent, contain and clean up any spillages in the environment;
- To reduce the noise associated with the operational activities as far as possible;
- To reduce the dust dispersion as a result of the disposal of material as far as possible; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.2.3 Transportation of ore via conveyors

The objectives for the transportation of ore via conveyors between the shafts and the ROM stockpile are:

- To prevent, contain and clean up any spillages in the environment; and
- To ensure that the conveyor is well maintained to prevent any spillages.

6.2.2.4 Processing of ore at the beneficiation plant

The objectives for the environmental management at the beneficiation plant are:

- To prevent any spillages into the environment;
- To manage and mitigate any spillage which may occur;

- To reuse water as far as practically possible by structuring the operations as a closed water circuit;
- To reduce dust creation; and
- To ensure legal compliance.

6.2.2.5 Operation of Paste Disposal Facility

The environmental objectives associated with the PDF are:

- To limit surface water within the PDF footprint according to best practices by utilizing paste technologies;
- To maintain water management infrastructure so as to prevent the failure of these systems;
- To reuse water as far as practically possible by an effective thickening and pumping system;
- To maintain the silt trap and RWD system to prevent siltation of the dam, thereby maintain the required 0.8m freeboard;
- To undertake the required monitoring programme and produce reliable, good quality data that can be used to continuously update the numerical model and water balance; and
- To ensure that health and safety procedures are followed.

6.2.2.6 Operation of Clean and Dirty Water systems

The objectives set for the clean and dirty water system, including water stored in voids are to:

- To maintain all pollution control systems in such a manner as to reduce any possibility of dirty water entering the natural or clean water systems;
- To operate the mine in a closed water circuit;
- To introduce measures to retain as much dirty water on site for reuse as possible;
- To ensure compliance to all best practices in terms of the operation of the dirty water systems;
- To maintain the integrity of the dirty water system, including the berms, bunds, drains;
- To ensure that all dirty water systems are cleaned and maintained on a regular basis to prevent pollution of the water resources and where pollution prevention is not possible, to minimise the impact on water sources (ground and surface);
- To achieve overall legal compliance; and

- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.2.7 Generation and handling of waste

The objectives for waste generation and handling of domestic, diesel and chemical storage are:

- Ensure that storage takes place in such a manner as not to cause any pollution to the environment;
- Ensure that storage facilities comply with best practice guidelines;
- Prevent any pollution of water resources by ensuring that an effective surface runoff control system is in place;
- Prevent, contain and clean up any spillages during the life of the mine; and
- Ensure that all facilities are monitored on a regular basis.

6.2.2.8 Hydrocarbon storage

The environmental management objectives for hydrocarbon storage are:

- To ensure that all hydrocarbons are stored in a manner which will prevent any harm to the environment;
- To prevent spillages of hydrocarbons;
- To capture, contain and manage any spillage;
- To ensure that any area which has been affected by a hydrocarbon spill is suitably rehabilitated and monitored until rehabilitation efforts have been successful.

6.2.3 Closure and Decommissioning

6.2.3.1 Removal of surface infrastructure

The objectives for removal of surface infrastructure are:

- To ensure that discussions are held with the relevant stakeholders to determine whether any existing infrastructure could be on a social or economic benefit before final removal is commenced;
- To ensure that the removal of infrastructure is done in a manner which has the smallest possible impact on the environment;
- To limit all rehabilitation activities and the movement of people to within the disturbed area footprint; and

- To ensure that no building rubble or rubbish remains after the removal of infrastructure.

6.2.3.2 Rehabilitation of disturbed areas

The objectives for the rehabilitation of disturbed areas are to:

- Ensure the removal of all contaminated material;
- Ensure that all compacted areas have been ripped; and
- Ensure that all disturbed areas are topsoiled and vegetated.

6.2.3.3 After monitoring and maintenance

The objectives for after care monitoring and maintenance are to:

- Ensure that an inspection of the water management infrastructure such as solution trenches, sumps, etc. is undertaken to identify which components need to be replaced to ensure long term functionality, until such time that monitoring indicates that there is no more potential for contamination;
- Ensure that monitoring takes place until rehabilitation measures are considered successful; and
- Ensure that storm water management infrastructure is rehabilitated and the area is made free-draining only once rehabilitation is completed.

7 IDENTIFICATION OF IMPACTS AND ISSUES WITH MANAGEMENT MAEASURES AND ACTION PLANS (EMP)

This chapter of the report fulfills the requirements of regulations 50 (a) to (e) and 51 (a) and (b) of the MPRDA Regulations, R527.

<u>REGULATION 50 (a):</u>

- *(Section 1- 3): The potential impacts*
  - *(Section 1-3.1): List of the potential impacts, on environmental aspects separately in respect of each of the aforesaid main mining actions, activities, processes, and activities listed in the NEMA EIA regulations.(include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department);*
  - *(Section 1 - 3.2): List of all potential cumulative environmental impacts;*
  - *(Section 1 - 3.3): State specifically whether or not there is a risk of acid mine drainage or potential groundwater contamination associated with the mineral to be mined. (If such a risk is associated with the mineral to be mined provide a summary of the findings and recommendations of a specialist geo-hydrological report in that regard).*

<u>REGULATION 50 (b)</u>

- *(Section 1 - 5)The potential impacts of the alternative land use or development*
  - *(Section 1 - 5.1): List of the potential impacts of each of the aforesaid main features and infrastructure related to the alternative land use or development and related listed activities;*
  - *(Section 1 - 5.2): Description of all potential cumulative impacts of the main features and infrastructure related to the identified alternative land uses or developments.*

<u>REGULATION 50 (c)</u>

- *(Section 1 - 6): Identification of potential social and cultural impacts.*

  - *(Section 1 - 6.1): List of potential impacts of the proposed mining operation on the socio- economic conditions of other parties' land use activities. .(include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department);*
  - *(Section 1 - 6.2): Description of the cultural aspect that will potentially be affected, and describe the potential impact on such cultural aspect. . (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable);*
  - *(Section 1 - 6.3): Description of heritage features and the potential impact on such heritage feature. (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable);*
  - *(Section 1 - 6.4): Quantification of the impact on the socio-economic conditions of directly affected persons, as determined by the findings and recommendations of a specialist report in that regard*
    - *(Section 1 - 6.4.1): The amount of the quantified potential impact on property or infrastructural assets;*
    - *(Section 1 - 6.4.2): State the amount of the quantified potential impact on commercial, economic or business activity which will be impacted upon as a result of the mining activity*
    - *(Section 1 - 6.4.3): The sum of the amounts, referred to in paragraphs 6.6.1 and 6.6.2 above.*

- *(Section 1-7): Assessment and evaluation of potential impacts.*
  - *(Section 1- 7.1.): List of each potential impact identified in paragraphs 3 and 6 above. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)*
  - *(Section 1 - 7.2.): Concomitant impact rating for each potential impact listed in paragraph 7.1 above in terms of its nature, extent, duration, probability and significance.(Provide a definition of the criteria used for each of the variables used for rating potential impacts and ensure that the potential impacts are rated specifically with the assumption that no mitigation measures are applied).*

  - *(Section 1 - 7.3.): Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the potential impacts rated.*

REGULATION 50 (e)

- *(Section 1 - 10): List of all the significant impacts as identified in the assessment conducted in terms of Regulation 50 (c) (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*

Regulation 51 (a)

- *(Section 2 -1): Description of environmental objectives and specific goals for mine closure.*
  - *(Section 2 - 1.1): Environmental aspects that describe the pre-mining environment.*
  - *(Section 2 - 1.2): Measures required to contain or remedy any causes of pollution or degradation or the migration of pollutants, both for closure of the mine and post-closure.*
- *(Section 2 – 2): Description of environmental objectives and specific goals for the management of identified environmental impacts emanating from the proposed mining operation. (As informed by the information provided in the EIA in terms of Regulation 50 (h)).*
  - *(Section 2 - 2.1): List of identified impacts which will require monitoring programmes.*
  - *(Section 2 - 2.2): List of the source activities that are the cause of the impacts which require to be managed.*
  - *(Section 2 - 2.3): Management activities which, where applicable, will be conducted daily, weekly, monthly, quarterly, annually or periodically as the case may be in order to control any action, activity or process which causes pollution or environmental degradation.*
  - *(Section 2 - 2.4): The roles and responsibilities for the execution of the monitoring and management programmes.*

- *(Section 2 – 3) Description of environmental objectives and specific goals for the socio-economic conditions as identified in the social and labour plan. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*
- (Section 2 – 4): Description of environmental objectives and specific goals for historical and cultural aspects.
    - *(Section 2 - 4.1): Environmental objectives and goals in respect of historical and cultural aspects identified in specialist studies conducted during the EIA phase.*

Regulation 51 (b) – Outline of the implementation programme

- *(Section 2 – 5): The appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspect in each phase of the mining operation, as follows;*
    - *(Section 2 - 5.1): Actions, activities or processes, including any NEMA EIA Regulation listed activities, which cause pollution or environmental degradation. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*
    - *(Section 2 - 5.2): Concomitant list of appropriate technical or management options chosen to modify, remedy, control or stop any action, activity, or process which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects as identified. (Attach detail of each technical or management option as appendices).*

- (Section 2 – 6): Action plans to achieve the objectives and specific goals contemplated in ***Regulation 50 (a)***
- *(Section 1 – 17): Time schedules of deadlines for each action to be undertaken to implement each technical or management option chosen. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*

7.1 Environmental Impact Significance Rating Methodology

To ensure uniformity, the assessment of potential impacts will be addressed in a standard manner so that a wide range of impacts is comparable. For this reason a clearly defined rating scale will be provided to the specialist to assess the impacts associated with their investigation.

Each impact identified will be assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To enable a scientific approach to the determination of the environmental significance (importance), a numerical value will be linked to each rating scale.

The following criteria will be applied to the impact assessment for the EIA/EMP:

<u>Occurrence</u>

- Probability of occurrence (how likely is it that the impact may occur?); and
- Duration of occurrence (how long may impact last?).

<u>Severity</u>

- Magnitude (severity) of impact (will the impact be of high, moderate or low severity?); and
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?).

In order to assess each of these factors for each impact, the following ranking scales were used:

Probability:=P	*Duration:=D*
5 – Definite/don't know	5 – Permanent
4 – Highly probable	4 - Long-term (ceases with the operational life)
3 – Medium probability	3 - Medium-term (5-15 years)
2 – Low probability	2 - Short-term (0-5 years)
1 – Improbable	1 – Immediate
0 – None	

Scale:=S	*Magnitude:=M*
5 – International	10 - Very high/don’t know
4 – National	8 – High
3 – Regional	6 – Moderate
2 - Local	4 - Low
1 – Site only	2 – Minor
0 – None	

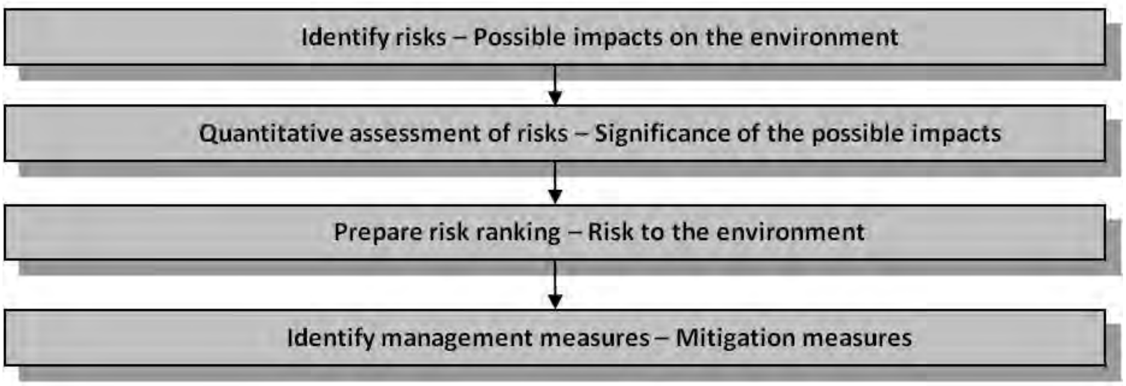
Once the above factors had been ranked for each impact, the environmental significance of each was assessed using the following formula:

SP = (magnitude + duration + scale) x probability

The maximum value is 100 Significance Points (SP). Environmental effects were rated as either of high, moderate or low significance on the following basis:

- More than 60 SP indicated **high (H)** environmental significance;
- Between 30 - 60 SP indicated **moderate (M)** environmental significance; and
- Less than 30 SP indicated **low (L)** environmental significance.

The following process will be followed:



The activities that will be assessed are described in Section 6.1 of this report.

7.2 Construction Phase

This chapter comprises the description of the potential impacts of the proposed construction activities on the biophysical, socio-economic and heritage and cultural environment. These descriptions are followed by the impact tables which contain the assessment of the significance of each identified impact without, then with mitigation measures. Each mitigation measure proposed is assigned a proposed action plan, frequency, associated management cost, as well as person responsible for implementation of the mitigation measures proposed to mitigate and/or manage each impact.

7.2.1 Topography

The construction activities are expected to change the natural topography due to the location of the proposed surface infrastructure in close proximity to the existing Assmang Black Rock Mine.

Due to the remoteness of the area and the lack of an established community/settlement within the immediate surrounds, this impact is expected to be of low significance. It is, however, recommended that the construction footprint is kept to a minimum and clearance activities remain within demarcated construction areas.

7.2.2 Geology

The geology of the area will be impacted on due to underground mining within the proposed Mukulu Mine area and at the adjacent Black Rock Mine. Although this impact is expected to be of medium significance, no mitigation is possible as mining permanently impacts on the geological strata. The mining activities will, however, remain within the mining right area.

7.2.3 Groundwater

7.2.3.1 Groundwater Quantity

No major impacts on the groundwater resource are expected during the construction phase of the project. Minor seepage will occur from the deeper fractured rock. No major groundwater inflow (excluding surface run-off and direct rainfall) is likely to occur in the new shaft area.

The main impact on water quantity is dewatering during the establishment of the mine shafts. Groundwater will be intersected during this part of the development and dewatering will be required to ensure a safe working environment. This will result in the dewatering of the groundwater systems in the immediate vicinity of shafts.

The drawdown of groundwater levels as a result of mine dewatering will be site-specific due to the short duration and the small scale of construction phase activities. No groundwater users will be impacted on by mine dewatering during the construction phase.

7.2.3.2 Groundwater Quality

Groundwater quality maybe impacted on by hydrocarbon or waste spillage, which can infiltrate and contaminate the groundwater system. These impacts can be easily avoided by the correct storage and handling of hydrocarbons and waste and the correct management of spills in line with this EMP.

The potential impacts on groundwater during the construction phase are of low significance.

7.2.4 Surface water

Due to the lack of surface water resources in the area, extremely low rainfall and high evaporation in the region, the surface water impacts during the construction phase will be of low significance.

This means that contaminated runoff, soil erosion during rainfall events are not likely to be issues during the construction phase. However, the risk aversion approach will be applied, and storm water management measures will be implemented before the footprint clearance begins.

The only exception is the animal watering pond on Belgravia 264 in close proximity to the proposed shafts. It is recommended that this pond is removed and replaced with another at a different location to prevent contamination and harm to animals once this shaft is phased in.

7.2.5 Wetland and Aquatics

There are no wetlands areas within 1 000m of any proposed surface infrastructure or shafts, therefore no wetlands will be impacted on by the proposed mine development.

7.2.6 Terrestrial Biodiversity

The proposed surface infrastructure plan for the proposed Mukulu Mine indicates that the proposed infrastructure will be located on the farm Mukulu 265, close to existing developments. This effectively limits the extent of impacts on the floristic environment.

Direct impacts on the vegetation, protected and conservation important species in particular, are regarded as significant. These impacts are unavoidable the removal and relocation of all protected forb and geophyte species prior to construction activities should be undertaken within the proposed construction footprint. Many impacts cannot be avoided, and although limited in significance and localised in extent, the application of definite mitigation measures will ameliorate their significance to only a moderate status.

Clear boundaries that will prevent the spread of direct impacts to surrounding natural habitat and the implementation of generic mitigation measures are expected to mitigate most impacts to a moderate and low significance level.

Ultimately, it is not expected that this development, when viewed in isolation, will affect the conservation status of floristic attributes adversely on a local or regional scale.

7.2.7 Soil, Land use and Land Capability

7.2.7.1 Impacts

The following impacts on soil and land capability of the proposed Mukulu Mine area have been identified.

- Loss of fertile topsoil layer due to stripping during construction. The removal of the topsoil layer removes the seedbed and soil carbon content. The effect of this will be localised within the site boundary but will have a long term effect that would stretch beyond closure of the project and will ultimately lead to the irretrievable commitment of this resource. The significance of this potential impact is considered to be medium. The measurable effect of the construction and operational phase on this resource and the likeliness of preventing or reducing the effect by utilizing mitigation measures are negligible.
- Soil compaction due to unnatural load in the area. This will change soil structure. The effect of this will largely be within the site boundary and will moderately deteriorate during operational phase but will subside with the decommissioning of the operations. If probable mitigating measures are not implemented the effect of the compaction will induce great threat to the original soil structure of soils on the site. The significance of this potential impact is considered to be medium.

- Soil erosion: soil will be prone to erosion because the vegetation layer will be removed that prevent wind erosion and erosion by the impact of water flow. Erosion will be localised within the site boundary but will have a long term effect that would stretch beyond closure of the project and will ultimately lead to the irretrievable commitment of this resource. The measurable effect of reducing erosion by utilizing mitigation measures will be effective if implemented correctly. The significance of this potential impact is considered to be high.
- Chemical soil pollution: The construction activities, mining and processing of manganese will result in waste generation that will be stored on site in waste dumps and paste disposal facility. Chronic manganese (Mn) exposure is a health hazard associated with the mining and processing of Mn ores. Construction and operational traffic on site may also result in oil and fuel spillage on soil. Due to the very sandy nature of the soils in the area it has low buffering capacity to prevent manganese and other related soil chemical pollution. The effect will stretch beyond the site boundaries and will ultimately lead to the irretrievable commitment of the immediate resources close to the operation. The significance of this potential impact is considered to be high.
- Change in natural soil profile: The original soil landscape will be disturbed by earthworks, infrastructure, pipelines, roads, etc. The change in natural landscape will have a long term affect and will stretch beyond the decommissioning of the project. The significance of this potential impact is considered to be low.
- Loss of current land capability: The project area largely consists of land with grazing and wilderness land capability. During the construction and operational phases of the project, large areas of land will be cleared of the original vegetation. This will result in a total loss of the land capability of the affected surface infrastructure area on Mukulu 265 and proposed shaft areas at Olivewood 284 and Belgravia 264. The significance of this potential impact is considered to be high to medium.

7.2.7.2 Soil Management

The highest impacts that the proposed development will have on the soil in the area is soil compaction associated with all components of the projects as well as soil erosion in areas where vegetation has been cleared. The aim of the soil management plan is to provide guidelines that should be followed during any phase of land preparation, clearing of vegetation or general construction activities.

<u>Strip a suitable distance ahead of the construction (disturbance) at all times, to avoid loss and contamination</u>

Do not strip too large an area ahead of construction, because this exposes the stripped surface to the risk of water and wind erosion, with the associated dust and water sediment pollution problems. However, if the stripping face is too close to the construction activity, it will result in the loss of valuable soil material. Contamination by overburden materials as well as chemical soil pollution by oil and fuel spills, etc. will occur.

<u>Supervise stripping to ensure soils are stripped correctly</u>

Close supervision and monitoring of the stripping process is required to ensure that soils are stripped correctly for common failings are stripping too little or too much. When too little, valuable rehabilitation materials are lost, when too much, good quality soil is contaminated with poorer quality and unsuitable materials which are frequently highly compactable and tend to cement when exposed at surface. Risks of soil loss or contamination are particularly high when soil stripping contracts are purely issued on volume stripped, rather than on volume and quality. Monitoring requires assessment of the depth stripped the degree of mixing of soil materials and the volumes of material replaced directly or placed on stockpiles.

<u>Avoid vegetation clearance and earthworks during the rainy season when chances of runoff and water erosion are highest.</u>

The indigenous vegetation currently protects the highly erodible sandy soil profiles of the study site. The A-horizon is also the most fertile horizon that stabilises plant roots and contains sufficient organic material to allow good water infiltration in the rainy season. This horizon will most likely be stripped during construction and once this layer is removed, the rest of the profile will be extremely susceptible to water erosion.

<u>Strip soils only when moisture content will minimise compaction risk</u>

Most soils are highly susceptible to compaction. Compaction is usually greatest when soils are moist, so soils should be stripped when moisture content is as low as possible. Stripping and replacement of soil should be done during the dry season when rainfall is at its lowest and soils are driest. When not practical, every effort must be made to minimise compaction by the methods used for soil stripping, stockpiling and replacement.

Strip and replace in one action wherever possible

Wherever possible, stripping and replacing of soils should be done in a single action. This is both to reduce compaction and also to increase the viability of the seed bank contained in the stripped surface soil horizons. Stockpiling both increases compaction and decreases the viability of the seed bank, and should only be done when no areas of reshaped impacted land are available for direct placement.

Locate soil stockpiles so that re-handling of soil is minimised

Soil stockpiles should not be moved after initial stripping unless the soil is being replaced in its final location in the rehabilitated profile. This is because each re-handling damages soil structure and increases compaction. Soil losses occur with each re-handling and additional cost is considerable. While it may cost more initially, it is better to place stockpiles in areas where they will not have to be moved. There will always be some soil that has to be stripped before any rehabilitated areas are available for direct placement (for example, soils stripped for roads infrastructure and box-cut development during construction), but these materials should be stockpiled as close as possible to where they are going to be ultimately used.

Ensure free draining location

Placing soil stockpiles in drainage lines has two major harmful effects: the soils become waterlogged and lose desirable physical and chemical characteristics and the risk of loss of soil materials due to erosion is increased. Ideally, stockpiles should be placed on a topographical crest which provides free drainage in all directions. Alternatively, a side-slope location with suitable cut-off berm construction upslope is acceptable and with a down gradient berm to prevent sedimentation of the surrounding receiving environment.

Minimise compaction during stockpile creation

Soils should be stockpiled loosely. The degree to which soils become compacted during stripping is largely dependent on the equipment used. If shovel and truck are used, the ideal is for soils to be dumped in a single lift. The use of heavy equipment over soil piles results in soil structure damage. If direct dumped soil piles are too low, then it is possible to increase stockpile height using a dozer blade or back-actor bucket to raise the materials.

Running trucks over the piles or using bowl scrapers or graders to level and shape stockpiles, is not recommended. When the only alternative to losing soil material is the use of unsatisfactory (i.e. bowl scraper) equipment, compaction damage can be reduced to some extent by stripping as thick a cut as possible and by dumping it as thickly as possible. In addition, deposition in a single track line may reduce to some extent the overall compaction of the dumped or replaced soil through the minimisation of the footprint area of disturbance.

7.2.8 Noise

Noise will be created during the construction phase due to the blasting for the establishment of the mine shafts, as well as the construction of surface infrastructure.

The proposed construction area on Mukulu 265 is located adjacent (south of) the existing Assmang Black Rock Mine. There is a village on Mukulu 265, to the east of the proposed surface infrastructure area, but Mr. Bava Reddy from Atlasa was informed during an informal meeting with Assmang Black Rock Mine representatives on 10 May 2012, that the village is currently not occupied.

There are furthermore no established residential areas within a 5km radius of the proposed surface infrastructure on Mukulu 265. The noise created during the construction phase is therefore not considered to be of high significance.

7.2.9 Traffic

The impact on traffic during the construction phase is considered to be of low significance, as this will comprise the use of main roads for construction vehicles, delivery of building material to the site and the transport of workers to and from the site daily.

Furthermore, these activities will be undertaken for a limited time, i.e. until the end of the construction period.

7.2.10 Visual

The proposed construction activities will have an impact on the aesthetics of the area, as well as created poor visibility conditions due to dust creation. These impacts, although also cumulative in nature, due to the proximity to the existing Assmang Black Rock Mine, will be of low significance due to the limited number of sensitive receptors in the study area.

7.2.11 Air Quality

Dust will be created when vegetation is removed and soils are rehabilitated. The lack of an established settlement in the vicinity of the mine, as well as the limited duration of the activities means that this impact will be of low significance.

Furthermore, this impact can be easily mitigated through dust suppression spraying of disturbed areas.

7.2.12 Heritage

Based on the location of the shafts on Mukulu 265, Olivewood 284 and Belgravia 264, as well as the surface layout provided by Main Street, all the sites of heritage and cultural significance are outside of the direct area of impact. There will, however be a secondary impact and therefore mitigation is needed.

The development may continue after implementation of the recommended mitigation and management measures. All archaeological and historical sites may not have been identified. Apart from natural factors this is also due to certain farms not being accessible at the time of the survey. It also is possible that subterranean archaeological sites may be found later on. On identification of these, they must be dealt with by an archaeologist.

The following sites may be subject to secondary impacts through the creation of dust during the development of the mine shafts:

- Graveyard sites (site no. 2, 3 and 6): Grave site are always regarded as having a high cultural significance. Exhumation is not recommended as there only will be a secondary impact. It is recommended that the grave sites are fenced in properly, maintained, managed and preserved, and that a heritage expert is appointed to compile a management plan for each of these sites. Access to possible descendants should be allowed. The heritage plan must be updated if the extent and location of mining activities changes;

- Sites No. 1, 4, 5, 7, 8 and 11 are similar to each other. They represent the unique architecture of the Kalahari. Although not very unique in this region, it is unique of this part of the country. The buildings should therefore be maintained. It is recommended that a heritage expert is a pointed to compile a management plan for the preservation of the building which may be impacted on by blasting activities during the construction phase. Any changes planned thereto (or possible demolition) should be discussed with the Northern Cape Provincial Heritage Resources Agency (PHRA) first.

Site no. 9 and 10 are of a low cultural significance and may be demolished. However should there be no need for this it can just be left as it is.

7.2.13 Socio-economic

The socio-economic environment of the area will be impacted on positively and negatively if the mine is developed. These impacts include those discussed in this section.

7.2.13.1 Increase in Population size (in-migration)

Increase in population size (in-migration) will be due to the settlement of people from other areas seeking employment (temporary workers during construction and permanent employees during the operational phase). The social impacts of in-migration are exacerbated when the newcomers are different from, or perceived as being different, from the current residents. An increase in population size can have a variety of social impacts, which ranges from impacts on individuals or households, to impacts on the community. These impacts, depending on the level of in-migration, can for example include:

- Impacts on individuals or households: Reduced level of health; reduced mental health; increased stress, anxiety, alienation, apathy, depression; uncertainty about impact, development opportunities, about own life as a result of social change; reduced actual person safety due to increased hazard exposure; and reduction in perceived quality of life (subjective well being);
- Impacts on community level: Reduced adequacy of infrastructure (water supply, sewerage, services and utilities); reduced adequacy of community social infrastructure, health, welfare and education facilities; reduced adequacy of housing; and increased workload on institutions.

- Surrounding towns, i.e. Kuruman and Kathu, are likely to experience the brunt of the influx of job seekers. This could potentially lead to conflict in terms of access to municipal in social infrastructure and services, including, most critically, housing.

Due to the site's proximity to other existing mines, it is expected that residents within towns surrounding the site will most likely form part of the workforce. It is advised that employment criteria, for all required staff, be made public in advance to deter unqualified job seekers from moving into the area, or other low income areas. It is furthermore advised, that as far as possible, local labour be employed at each phase of the project, especially during the operational phase. Measures should be implemented to verify that job applicants are from local areas. This may require the assistance of appointed community representatives, ward councilors, Community Liaison Officers, etc.

An influx of construction crew during the construction phase, and permanent staff (i.e. administration staff, security, etc) will place an increased burden on the available infrastructure in the towns of Hotazel, Kuruman and Kathu.

7.2.13.2 Effect of temporary workers on social dynamics

The potential in-migration of workers is likely to result in impacts such as conflict with existing community members, social inconveniences and / or problems and pressures on existing infrastructure. The potential in-migration is anticipated to have an effect on the nearby towns of Blackrock and Hotazel)

These impacts are expected to occur during the construction and operation phase. It is advised that, as far as possible, construction workers are housed in towns such as Kuruman and Kathu. The ability of Kuruman and Kathu to accommodate the additional workforce should be addressed in liaison with the local municipality governing those towns.

7.2.13.3 Waged labour

Waged labour can be defined by an impact that changes the number of available jobs in an area.

The construction of the proposed mine is expected to be completed within 24 months and will create temporary jobs for this period.

7.2.13.4 Conversion and diversification of economic activities

During consultation with landowners it has been established that, should additional mining be undertaken in this area, the current land use of the area, i.e. cattle farming, would be placed under pressure due to water scarcity issues.

Local Economic Development (LED) projects by the mine, such as community outreach programmes, infrastructure development projects; etc may improve basic services, schooling and health care in the area. This impact is seen as positive for the local economy; however, water quality issues should be addressed in order to prevent any negative impact on local farmers.

7.2.13.5 Employment creation and decrease in unemployment

The development will directly influence changes in employment and income opportunities in the nearby communities. This will comprise both temporary and permanent (long term) changes in the income profile of the community.

The employment opportunities created and those created from new business sales will bring relief to the high unemployment figures in the area, thereby impacting on crime and poverty. This will not, however, solve unemployment in the region.

Employment opportunities during the construction phase would be temporary (contractors, labourers, artisans and service providers). Increased employment will result in increased expenditure, which will mean economic benefits in other sectors of the economy.

It is anticipated that an increased number of Historically Disadvantaged Individuals (HDI) could be provided with an annual income, which will place them in the position to acquire the goods and services required to maintain a basic level of living. Employment creation also often leads to the softening of negative social impacts such as illiteracy, the lack of proper healthcare or crime and violence.

Indirect business opportunities, including catering and transportation services (taxis), will mainly flourish during the construction phase, but with the necessary support, may grow within the operational phase. It is advised that these businesses be provided with the necessary skills base and financial support to eventually create a more sustainable human settlement.

In order to maximise this positive impact, local labour should be used as far as possible, i.e. local residents and people from surrounding towns. This enhances the living standards of local people. It is suggested that, where possible, Main Street advise and assist, in liaison with the local ward committees, local business operators to establish and grow SMMEs. The process of supporting local business and the use of their products and services can form part of Main Street's SLP responsibilities.

It is suggested, that in order to effectively utilise local labour, that a skills survey be undertaken locally (if none are available). Should a skills register or a labour desk for local unemployed persons, however, not be feasible, it is suggested that employment be undertaken through assistance from the ward councillors and local Non Government Organisations and elected community leaders.

7.2.13.6 Conversion and diversification of land use

Conversion and diversification of land use refers to the change in the way land is used, both in terms of the area of land appropriated for a particular activity, the intensity of the use of the land and whether there are areas of land not used for production, and in terms of the type of land use activities and the pattern or mix of those activities.

The land use patterns of the surrounding area comprise of farming (cattle grazing) and mining with intermittent residential use. The current surrounding land use, and on site is agricultural (cattle grazing). The land use patterns, other than the farm Mukulu, are unlikely to be impacted on and changed by the proposed new mine. In most instances, these activities can continue.

However, once the proposed shaft on the farm Olivewood 284 is developed, the land use on this farm may be permanently altered. It is suggested that an updated Social Impact Assessment be conducted at the point in time when this shaft becomes viable. The possible relocation of the landowner, the effect it will have on surrounding landowners, etc will have to be investigated and mitigated.

7.2.13.7 Transportation (traffic) and accessibility

The proposed mine may impact on the roads and transport facilities within the proximity of the site. It is expected that Main Street will contribute towards the upkeep of the roads on which they operate.

The impact on roads is considered to be of low significance as the construction phase will be over a limited time period (approximately 2 years) and the only vehicles which will travel on roads will be the construction vehicles, delivery vehicles which transport building materials to the site, as well as transport vehicles to transport workers to and from the site daily.

7.2.13.8 Capacity building and skills transfer

Capacity building refers to the conscious increasing of knowledge, networking capability and the skills base amongst local people. It is predicted that the proposed mine will add to capacity building in the community, as opportunities exist to develop the skills of local residents. This type of skills development should however encompass more skills than merely the technical skills of the construction or the operational phases and should include life skills training and mentorship. In terms of training, it is required that all employees be trained in the function of their job and must incorporate health, safety, security and environmental aspects. The development and support of SMMEs in the local communities should also be encouraged.

Allied with the additional temporary jobs created during the construction phase, and the permanent jobs created during the operational phase, there will be enhanced opportunities for skill acquisition.

The skill acquisition during the construction phase will probably be limited to on the job training. The skills acquired by the construction workers should enable them to explore similar construction related employment opportunities after the completion of the construction phase.

7.2.13.9 Deviant social behaviour

This impact can be defined as types of social behaviour that might be considered deviant or antisocial, such as excessive alcohol consumption, illegal drug use, various types of risk-taking behaviours and vandalism. It is expected that this impact will, to varying degrees, occur during the construction and operational phases of the new mine. There is a risk that the presence of “incoming” workers and or the influx of jobseekers can lead to deviant social behaviour in the communities they occupy.

During the construction and operation phase it is possible that petty crime in the area could increase as a result of the influx of strangers into the area. It is strongly recommended that the South African Police Services (SAPS), in association with existing Community Based Organisations and NGO's be used to monitor and assist with the management of the negative social effects of incoming job seekers and strangers. These organisations will ensure that conditions stipulated by the EMP be fully complied with.

7.2.13.10Actual health and fertility

The Occupational Health and Safety Act (Act 85 of 1993) (OHSA) as well as the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) provide for the protection of the health and safety of employees and other persons at a mine. The prevention and management of mining related incidents such as underground fires are addressed by these Acts.

Mining related public health impacts due to possible air/dust pollution, noise pollution, light pollution and the potentially negative impact on the water quality should also be considered. Main Street should strive to abide by the abovementioned Acts, in addition to international best practice guidelines.

All phases of the operation must comply with the OHSA and MHSA.

7.2.13.11Perceived health

Generally there seems to be a negative connotation to mining and mine-related activities. Mines are commonly considered as unsafe and mining activities and processes are deemed the cause for air pollution in the form of dust. The pollution of water, acid mine drainage, the abstraction of ground water resources, etc all form part of common concerns. However, the use of new technologies, advanced rehabilitation programmes, the implementation of a vast number of mitigation measures, coupled with the annual auditing of the application of the EMP, should allay most of these fears.

Even though fears of de-watering may be mitigated, the perceived impact is very high. Mitigation measures suggested by the various specialist studies should be communicated to the affected landowners and their input and recommendation should be incorporated therein. Frequent updates (bi-annually) should be provided to affected landowners.

7.2.13.12 Feelings in relation to the project

Proposed projects and developments often generate uncertainty, anxiety or fear and sometimes, the impacts perceived in anticipation of the planned intervention can be greater than the impacts that ultimately result from the intervention (Burge and Vanclay, 1995). These impacts include uncertainty, annoyance, dissatisfaction due to a failure of the project to deliver promised benefits and an experience of moral outrage, for example where a project leads to violation of deeply held moral or religious beliefs or requires households to relocate their houses to make way for the new project.

Although the feelings of residents may be biased sometimes, they should not be disregarded. In order to develop the mine in a responsible manner, Main Street should take cognizance of biophysical and social impacts. Social impacts are often subjective and there is a need to address both actual and perceived impacts.

It is therefore suggested that a detailed and transparent PPP be followed in order to address any feelings of mistrust. Furthermore, all I&APs should be kept informed on the progress of the mining right application and all potential benefits (or impacts) that may derive, should the mining right be approved.

7.2.13.13 Physical quality of the living environment (actual and perceived)

Social impacts experienced in the physical environment relate to exposure to dust, noise, risk, odour, vibration, artificial light etc.

At any and all types of mines, the mining method and/or processes and actions taken, will have the potential to create pollution/environmental degradation. While these may differ from mine to mine only experience will enable officials to easily identify these. Some factors may not be readily measurable and may not be visible at all. Still, all mines have at least some pollutants that are common to all:

- **Noise:** The impacts of noise levels can be both physical and physiological at the high end of the spectrum but more commonly impact on communication or create psychological effects at the lower end of the spectrum. The negative community response even to relatively low noise levels is one of the most common environmental considerations;
- **Dust:** Dust created at a mine could increase as a result of failure to control its natural proliferation, like rock dumps, or from increased physical activity, like crushing or transport. Dust is one of the most visible, invasive, irritating and

potentially harmful forms of pollution. Dust has a high nuisance impact, lowering the quality of life in surrounding communities.

- **Aesthetic:** All mines scar the landscape, either by limited physical impacts or, from a larger perspective, by breaking the skyline and the natural contours or flow of the surrounding landscape;
- **Water** – The objective of the United Nations Millennium Development Goals on water is a 50% reduction in the number of people without sustainable access to safe drinking water, by 2015. Main Street should, as far as possible, explore opportunities to minimise water usage, maximise water reuse and recycling and reduce the impact their operations will have on the freshwater and underground water resources in the regions where they operate; and
- **Waste** – All mines produce domestic, industrial and mineral waste products. The ratio of waste produced and the potential for production of saleable waste from the products depends on the commodity and demand. During the construction phase, the illegal dumping of waste must be avoided at all cost. During the operational phase, it is suggested that Main Street continually seek opportunities to minimise the generation and disposal of waste products through recycling, waste minimisation programmes and improvement of operational practices and processes.

7.2.13.14 Aesthetic quality of the living environment

The visual impact of a mining development is influenced by the terrain, relief of surrounding areas as well as by the population density, transport routes or other development nodes, which will all impact on its visual absorption capacity. Mine's may also be able to impact on the "Sense of Place", that quality that makes the place unique or distinct with a character of its own. Visual quality or aesthetic appeal might also be affected if the degree of visual diversity or complexity, discernible textures or patterns or striking features and the landscape character are impacted.

A new mining development with its above ground infrastructure (shaft, rock dump, etc), together with the other existing mines in the surrounding area could have an impact on the adjacent farmers. However, since the main infrastructure will be directly opposite the existing Black Rock Mine, the visual impact, although it is cumulative in nature, will be of a lesser extent.

7.2.13.15 Availability and quality of housing

The established migrant labour practice has created socio-economic problems in the labour source areas in South Africa and surrounding countries as well as within the mine and adjacent urban communities. The single-sex hostels of large mines have been a specific source of social problems and political unrest. The resultant disruption of social patterns in the mine and source community is reflected in the spread of diseases linked to lowered socio-economic conditions. It is advised that housing allowances and transportation are provided and paid for rather than constructing hostels permanent employees.

Due to the costs involved in the development of a mining town and the costs subsequent to mine closure the most commonly used option is long-distance commuting to and from established towns.

Exercising this option avoids the costs of establishing a new settlement; workers often migrate without their families and therefore need only the basic amenities. However, problems with this system can be experienced at the community or regional level. In instances where the mines do not contribute to the infrastructure of the local communities, the local communities benefit very little, or not at all, from the mines in their area, which can have serious implications for regional development.

The mine could address the transitory nature of housing in mining towns such as Hotazel and Black Rock by providing a range of rental options. It is therefore suggested that homeowner education be provided to all permanent employees, including a section on the realities of mining towns and the likelihood of diversification.

The assertion that permanent employees will be housed in either Kathu or Kuruman should be investigated. Housing within these towns is already under serious strain with limited infrastructure available to existing residents. Main Street should present their housing proposal to the applicable local municipalities and come to an agreement before the mining commences.

7.2.13.16 Adequacy of physical infrastructure / increased pressure on existing infrastructure

The proposed new mine may have impacts on the current level of physical infrastructure (roads, bulk water services, electricity, housing, etc.) in the area. An increase in economic activity and population size could have implications for community infrastructure and service requirements.

The actual construction of the mine would require bulk services (water, electricity) that would cause negative pressure to existing infrastructure. During the operational phase of the mine, more pressure would be exerted on infrastructure.

The mine would put further pressure on an already stressed electricity supply system. The absence of appropriate planning has the potential to increase pressure on bulk infrastructure beyond sustainable levels.

In terms of the adequacy of the physical infrastructure it is advised that the proposed project be aligned with the existing infrastructure (access roads, power lines, railroad, etc.) as the necessary infrastructure would already be in place. However, Main Street, in liaison with the Joe Morolong LM, must ensure that the already existing infrastructure be upgraded and maintained to service both the needs of the mine, as well as the local farmers and community members. Additional infrastructure should be provided where required (i.e. sewerage and water supply).

Should the required additional infrastructure not be in place by the time that the operational phase commences, it could have significant impacts on the surrounding community and farmers. Not only will it add to significant inconveniences to affected parties, but it may also affect the successful operation of the mine.

A transport service for transporting workers to and from their places of residence will have to be provided, which will result in large vehicles and an increase in traffic to and from the mining site. Main Street, in liaison with the local roads and traffic department should seek ways of addressing this impact.

7.2.13.17 Adequacy and access to social infrastructure

As a result of the proposed new mine, the new residents and their associated activities will require a variety of services provided by the public and private institutions. The goods and services include cultural and recreation facilities; education; health care; special care for the elderly, the disabled, the indigent and pre-school-age children; police and fire protection; and a variety of administrative support functions.

Service resources are objective indicators of the level of resources available for the satisfaction of society’s needs, e.g. the number of physicians, dentists, acute-care hospital beds, and psychiatric care hospital beds are indicators of the level of health care resources. Square meters of parks, picnic areas, children play areas, etc., are indicators of facilities for recreation needs.

In terms of the MPRDA, the applicant for a mining right must, through the means of its SLP, ensure that it fulfills its responsibilities (i.e. provision of physical and social infrastructure) to the communities in which they will operate, as well as the communities from where they will source their labour. The SLP requirements furthermore state that these projects should be decided on, in consultation with the LM and in cognisance of their approved IDP document. LED projects should confirm to certain criteria, which include:

- Promote employment and advance the socio-economic welfare of all South Africans;
- Contribute towards the transformation of the mining industry;
- Contribute towards the sustainable socio-economic development of the area of operation; and
- Ensure job creation and income generation opportunities.

It is therefore anticipated that the proposed mine would result in social development and social services support through local economic development. Care should, however, be taken to communicate LED commitments and timeframes in a clear and unambiguous manner and to implement these projects as soon as possible. Failure to implement projects could lead to a situation whereby the local communities are disillusioned by Main Streets' commitments.

7.2.13.18Personal safety and hazard exposure

The potential impact can be twofold, i.e. personal safety and risk exposure due to the mine infrastructure itself, or due to the influx of strangers entering the local communities or farms.

The safety of workers and property owners and other residents within close proximity to the study area may be impacted on during the construction phase. These impacts are related to the movement of construction vehicles transporting goods and materials on the roads leading to the site (e.g. heavy machinery, heavy vehicles, and earthmoving equipment), in addition to the transport of construction personnel.

Furthermore, the influx of potential jobseekers could lead to an increase in the local population, which could have cumulative impacts such as negative social behaviour, petty crime, violence and conflict with local residents.

A more direct threat is the potential of veld fires occurring due to the presence of construction workers and construction related activities on site. This could pose a threat to livestock, residents and houses in the area.

7.2.13.19Crime and violence

The influx of potential job seekers, as well as the increase in movement and activity as a result of mining activities in areas in close proximity to the mining activities is likely to result in an increase of petty criminal activities.

It is also anticipated that the influx of newcomers will lead to the increase of actual crime and violence in the local communities. There is often fierce competition for job opportunities, and should newcomers to the area be employed, rather than local community members, this could result in resentment and even violence.

7.2.13.20Loss of natural and cultural heritage

South Africa is a multi-cultural society and urbanisation has resulted in many of the diverse cultures sacrificing their cultural integrity. The National Heritage Resources Act 25 of 1999 and Provisional Declaration of Types of Heritage Objects (General Notice No. 630 of 2000) are concerned with the protection of heritage and promotion of history and culture.

Protection of archaeological sites and cultural heritage is an important factor in mine planning, both in the context of greenfield and brownfield developments. Whereas previously undeveloped sites require archaeological investigations of areas to be disturbed many of the old mines preserve buildings or other cultural sites that are either protected or worthy of conservation. A cultural resource management investigation is a necessary part of any mine development and closure plan to ensure that the developer is aware of the range of cultural issues that could constrain the development or post-closure land-use options.

In this regard, the recommendations of the Heritage Impact Assessment, conducted as part of the EIA should be implemented.

7.2.13.21Functioning of government agencies

Integration of mining with the community and local government structures should be addressed at two levels. The IDP of the local authority should recognise mining as an important, often strategic, development and ensure that land-use planning and zoning makes provision for the demarcation of current mining areas and possible future expansion. This will reduce the potential for negative impacts on sensitive developments such as housing, roads and health care facilities.

The Mineral and Petroleum Resources Royalty Act gives effect to Section 3(2) (b) of the MPRDA, which reads: *"As the custodian of the nation's mineral and petroleum resources, the State, acting through the Minister may: in consultation with the Minister of Finance, determine and levy, any fee or consideration payable in terms of any relevant Act of Parliament. Resource royalties are not a tax; they instead represent compensation for the permanent loss of non-renewable commodities."*

The MPRDA brings South Africa's mining legislation in line with prevailing international norms. All mineral rights will henceforth vest with the State as custodian of minerals resources on behalf of South African citizens. The royalty bills which complements the MPRDA provides for the compensation to the State (as custodian) for the country's permanent loss of non-renewable resources. Whereas consideration for the extraction of mineral and petroleum resources was previously payable to the State only in certain cases (i.e. where mining was conducted on State land), the exploitation of all minerals and petroleum resources in South Africa henceforth requires consideration in the form of mineral and petroleum royalties payable to the State.

7.2.13.22Impact equity

Impact equity refers to fairness of the distribution of impacts (positive and negative) across the community. People who will benefit from the development must also share in carrying the costs. The project will lead to gain on a regional level, whereas the local communities such as the local farming community will not necessarily benefit in terms of financial benefits and employment opportunities.

It is therefore important to recognise that infrastructure developments such as this mine must be sustainable and recognise people as an element of the environment. The implementation of the SLP will therefore play a major role in ensuring that impact equity take place. The implementation of the SLP must further ensure that adequate social planning and infrastructure development take place and ensure that it can be maintained by the communities after mine closure.

7.2.13.23 Gendered division of labour

In most societies certain roles, occupations, responsibilities and qualities are associated with being male or female (i.e. gendered division of labour). While some of these roles have biological origins, many are socially constructed and deeply entrenched by history and tradition. Traditionally, women are represented in the caring professions (i.e. healthcare, education, etc) and lacks representation in high paying professions, such as engineering (mining, construction and manufacturing).

Women still face barriers to entering and participation in the mining sector, even though South African legislation compels mining companies to employ women at all levels. The lack of participation has been attributed to low levels of education (specifically technical training), companies with unsupportive work cultures, a lack of mentors for women in the workplace and the lack of facilities and attention to ergonomics for women in mining (AngloGold Ashanti, Report to Investors, 2005).

A greater understanding of the barriers women face in the mining sector could improve women's opportunities in the sector, and assist in achieving the targets set out in legislation (i.e. 10% of women in mining).

In the context of sustainable development, gender equity is based on grounds of human rights and since 1994 a number of laws have been passed that is concerned with social transformation. Amongst these laws are the Employment Equity Act, 1998 (Act No 55 of 1998), the Preferential Procurement Framework Act (Act No 5 of 2000), the Broad Based Black Economic Empowerment Act, 2003 (Act No 53 of 2003) and the MRPDA, supported by the BBSEEC, which expands on the social provisions of the MRPDA.

7.2.14 Cumulative Impacts

7.2.14.1 Topography

The construction activities are expected to extend the impacts on the natural topography due to the location of the proposed surface infrastructure in close proximity to the existing Assmang Black Rock Mine.

Due to the remoteness of the area and the lack of an established community/settlement within the immediate surrounds, this impact is expected to be of low significance. It is, however, recommended that the construction footprint is kept to a minimum and clearance activities remain within demarcated construction areas.

7.2.14.2 Geology

The geology of the larger area will be impacted on due to underground mining within the Mukulu Mine MRA and at the adjacent Black Rock Mine. Although this impact is expected to be of medium significance, no mitigation is possible as mining permanently impacts on the geological strata. The mining activities will, however, remain within the mining right area.

7.2.14.3 Groundwater

It is expected that groundwater will be removed during the establishment of shaft infrastructure. Deeper aquifers are already dewatered to a certain extent due to existing neighbouring mining activities. It is recommended that monitoring, which should begin prior to construction (to establish the baseline conditions) should continue during construction. Predictive modeling should be used to determine if any water users will be impacted on.

It is recommended that the mine maintains contact with surrounding landowners to address any potential issues associated with the impact on their groundwater resources.

Groundwater quality will be impacted on by hydrocarbon or waste spillage, which can infiltrate and contaminate the groundwater system. These impacts can be easily avoided by the correct storage and handling of hydrocarbons and waste and the correct management of spills in line with this EMP.

7.2.14.4 Biodiversity

The cumulative impact of numerous similar developments in the immediate area as well as regionally, is considered significant and should form the subject of a provincial and/ or regional overview.

7.2.14.5 Socio-economic environment

The cumulative social impacts of mining tend to:

- Manifest themselves in alterations to the traditional social practice and core cultural identity of the community;
- Occur later in the project cycle than direct and indirect social impacts; and
- Be more irreversible than direct and indirect social impacts.

Cumulative impacts are, however, also influenced by other social change processes, independent from the mining activity. It therefore becomes nearly impossible to correctly identify the true sources of social impacts.

Cumulative impacts that can, potentially, grow out of the development of the mine include both positive and negative impacts. From a positive viewpoint, the mine will create job opportunities, which will lead to the economic development of the region. This could in turn have a myriad of positive impacts on the region, and even the country as a whole. However, some negative impacts, such as the spread of HIV/Aids and its influence on the general health of the communities surrounding the mine, could also have far reaching impacts. The premature deaths of parents could for example lead to an increase in Aids Orphans, which in turn places a bigger burden on the LMs to address their social, educational, health and welfare issues.

7.2.15 Construction Phase Impact Assessment and Management Programme

The impacts which are anticipated during the construction phase were assessed and the results of this assessment are presented in the tables which follow. Each table also includes the required action plan, frequency of the management measures, the associated costs per annum, as well as the person responsible for undertaking the required actions.

The construction phase impacts on the biophysical and heritage environment are described under Sections 7.2.1.1 to 7.2.1.5.

It is difficult to ascribe particular socio-economic impacts to particular physical construction activities, therefore the socio-economic impacts associated with the construction phase are presented under Section 7.2.1.6.

7.2.15.1 Footprint Clearance

The potential impacts on the biophysical environment associated with the footprint clearance prior to construction of surface infrastructure and the development of shafts is presented in Table 7.1.

Table 7.1 Mukulu Mine Construction Phase Impact Assessment and Management Plan: Footprint Clearance

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Construction Phase: Footprint Clearance																		
Issues related to TOPOGRAPHY																		
Change in natural topography	Vegetation removal and shaping of landscape	4	4	2	3	30	L	• Demarcate construction footprint and limit activities to within this footprint as far as possible; • Keep the clearance area as small as possible; and • Keep as much original land cover as possible.	2	4	2	2	16	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
Change in natural topography	Uncontrolled erosion of surfaces	1	5	1	2	14	L	• Demarcate construction footprint and limit activities to within this footprint as far as possible; • Keep the clearance area as small as possible; • Keep as much original land cover as possible; and • Implement storm water management plan (SWMP) as early as possible to reduce potential for erosion.	1	5	6	4	48	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Project Manager	Included in construction cost
															Maintain and monitor the implementation of dirty water separation.	During construction	Environmental Control Officer	Included in construction cost
Issues related to GEOLOGY																		
None	Vegetation removal	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Dilution of fertile topsoil component	Vegetation removal, shaping and compaction of landscape	1	5	8	5	70	H	• The construction footprint should be kept as small as possible; • Keep as much original land cover as possible; • The majority of stripped soils should be stockpiled as a berm upslope surrounding the disturbed area; • Soil stockpiles must be sampled, ameliorated (fertilized) and re-vegetated as soon after construction as possible. This is in order to limit raindrop and wind energy, as well as to slow and trap runoff, thereby reducing soil erosion. Grassland and shrub species indigenous to the area are preferred.	1	5	6	4	48	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Ensure that soil management measures are included in vegetation clearance plan	Prior to construction	Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost

Loss of topsoil stabilisation	Vegetation removal, shaping and compaction of landscape	10	5	8	5	70	H	• Keep as much original land cover as possible; • Stripping of topsoil should not be conducted earlier than required (maintain grass cover for as long as possible) in order to prevent the erosion (wind and water) of organic matter, clay and silt; and • Topsoil stockpiles should not exceed 1.5m without the necessary erosion control measures.	1	3	4	4	32	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
Loss of grazing land capability	Vegetation removal, shaping and compaction of landscape	10	5	8	5	70	H	• Rehabilitate land as close to the original land-use as possible; and • Erosion control measures such as intercept drains and toe berms must be constructed where necessary.	1	3	4	4	32	M	Compile rehabilitation strategy for the construction and operational phases	Prior to construction	Project Manager	Included in construction cost
															Monitor rehabilitated areas. Return to areas after 18 months to ensure rehabilitation has been successful	During and after construction	Environmental Control Officer	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Soil compaction	Movement of vehicles over soil surface	2	4	6	4	48	M	• Keep infrastructure localized to reduce footprint; • When stripping machinery is used for stripping, stockpiling and 'topsoiling' operations, it should operate when the soil moisture content is below approximately 8 % (during the dry winter months) in order to limit soil compaction and machinery getting stuck; and • Tracked vehicles are more desirable than wheeled vehicles due to their lower point loading and slip, while vehicle speed should be maintained in order to reduce the duration of applied pressure, thereby minimizing compaction.	2	4	4	4	40	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Implement speed limits for all vehicles	During construction	Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected	Footprint clearance	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
Direct impacts on Red Data (RD) fauna species	Footprint clearance	10	5	2	5	85	H	• Limit all impacts only to the approved development footprint, preventing all direct and indirect impact on areas of natural habitat situated adjacent to the approved footprint areas; • Implement a suitable buffer zone (at least 30m) between the edge of sensitive habitat and any type of development or surface disturbance. • Implement a suitable buffer zone around wetland habitat, taking cognisance of recommendations from the wetland	10	5	3	2	3	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost

								specialist. • Prevent contamination of surrounding areas of natural habitat, from stockpiling, conveyor lines, water treatment facilities or any other source of pollution; • Relocation of Red Data species may only be done under the authorisation of a fauna permit granted by the NCDENC.							Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Loss or degradation of natural fauna habitat	Footprint clearance	8	5	2	5	75	H	• Limit all impacts only to the approved development footprint, preventing all direct and indirect impact on areas of natural habitat situated adjacent to the approved footprint areas; • Implement a suitable buffer zone (at least 30m) between the edge of sensitive habitat and any type of development or surface disturbance; • Implement a suitable buffer zone around wetland habitat, taking cognisance of recommendations from the wetland specialist; • Prevent contamination of surrounding areas of natural habitat, from stockpiling, conveyor lines, water treatment facilities or any other source of pollution;	8	5	3	2	32	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Disruption of ecological connectivity and migration routes/ territorial infringements	Footprint clearance	6	5	2	5	65	H	• Limit all impacts only to the approved development footprint, preventing all direct and indirect impact on areas of natural habitat situated adjacent to the approved footprint areas; • Implement a suitable buffer zone (at least 30m) between the edge of sensitive habitat and any type of development or surface disturbance; • Implement a suitable buffer zone around wetland habitat, taking cognisance of recommendations from the wetland specialist; • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.	6	5	2	2	26	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Direct impacts on common fauna species & interactions with structures & personnel	Footprint clearance	6	4	2	4	48	M	• No roads should be allowed within ecologically sensitive areas. The use of roads around ecologically sensitive areas for the purpose of buffers should be done with circumspect particularly in view of accidental killing of animals; • No animal may be hunted, trapped, snared or captured for any purpose whatsoever; • Fences and boundaries should be patrolled weekly in order to locate and remove	6	4	2	2	24	L	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost

								snares/ traps; • Vehicular traffic should not be allowed after dark in order to limit accidental killing of nocturnal animals; • Speed of vehicles should be limited to allow for sufficient safety margins; • Security lights should be strategically placed as to have the least impact on the surrounds; • Dangerous animals should be handled by a competent person; Compile a graphic list of potentially dangerous animals and present this to all workers as part of site induction; • Sensitize all personnel to the presence, characteristics and behaviour of animals on the site; • Include suitable procedures in the event of encountering potentially dangerous animals on the site; • Ensure that a snake handler and/ or anti venom serum is available at all times, together with a competent person to administer this serum; and • No domestic pets should be allowed on the site.							Implement speed limits for all vehicles	During construction	Project Manager	Included in construction cost
															Provide first aid kits at the construction site	During construction	Contractor/Project Manager	Included in construction cost
															Appoint competent person to be available for the handling of snakes during the construction phase	Prior to construction	Project Manager	Included in construction cost
Issues related to FLORA																	
Direct impacts on flora species of conservation importance	Clearance of vegetation and movement on site	10	4	3	5	85	H	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting; • Marking shall be done by steel stakes with tags, if required; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance; • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures; • Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; • The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard and should be guided by safe practice guidelines; • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted. • Locate, remove and relocate all plant species of conservation importance that are present within development areas.	6	4	2	3	36	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Appoint biodiversity specialist to undertake removal of Red Data species where necessary (in accordance with the necessary permits)	Prior to construction	Project Manager	Included in construction cost

Loss or degradation of natural vegetation/ pristine habitat	Clearance of vegetation and movement on site	6	4	2	3	36	M	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • Demarcate construction areas by semi-permanent means/material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance; • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures; • Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; • The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard and should be guided by safe practice guidelines; • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted;	4	4	2	3	30	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Direct impacts on ecological connectivity & ecosystem functioning	Clearance of vegetation and movement on site	6	4	2	3	36	M	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • Demarcate construction areas by semi-permanent means/material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance; • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures; • Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; • The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard and should be guided by safe practice guidelines; • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.	4	4	2	3	30	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost

															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Loss/ degradation of surrounding habitat	Clearance of vegetation and movement on site	6	4	2	2	24	L	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • Demarcate construction areas by semi-permanent means/material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance.	4	4	2	2	20	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
Impacts on SA's conservation obligations & targets	Clearance of vegetation and movement on site	4	4	2	2	20	L	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • Demarcate construction areas by semi-permanent means/material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance.	4	4	2	1	10	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
Increase in local and regional fragmentation/ isolation of habitat	Clearance of vegetation and movement on site	4	4	2	2	20	L	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • Demarcate construction areas by semi-permanent means/material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance.	4	4	2	1	10	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
Increase in environmental degradation, pollution (air, soils, surface water)	Clearance of vegetation and movement on site	4	4	2	2	20	L	• Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance; • Prevent contamination of natural habitat from any source of pollution.	4	4	2	1	10	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to AIR QUALITY																		
Creation of dust	Clearance of vegetation and movement on site	6	2	2	4	40	M	• Demarcate construction footprint and limit activities to within this footprint as far as possible; • Keep the clearance area as small as possible; and	4	2	2	2	16	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost

								• Keep as much original land cover as possible; Implement dust suppression spraying where necessary; • Implement dust suppression spraying.							Implement air quality monitoring programme	Prior to construction	Environmental Coordinator with air quality specialist	R90 000
															Provide dust suppression equipment and water.	During construction	Contractor	Included in construction cost
Issues related to SURFACE WATER																		
Belgravia site: Existing animal watering pond removal	Removal	6	4	1	4	44	M	Replace existing watering pond with new pond before it is removed	2	1	1	2	8	L	Establish new watering pond with the assistance of an appointed biodiversity specialist	This will be done during the operational phase, as this shaft will only be developed during operation	Project Manager	Included in construction cost
Contamination from dirty runoff	Clearance	2	2	2	2	12	L	Storm water Management Plan must be implemented before footprint clearance	2	1	2	1	5	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to GROUNDWATER																		
None	Footprint clearance	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Footprint clearance	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to Noise																		
Use of construction vehicles, hauling of building material to and from the construction site as well as the maintenance of equipment/machinery	Footprint clearance	6	2	1	3	27	L	Limit construction activities to the daytime.	4	2	1	2	14	L	Compile work schedule for the construction phase activities including timeframes	Prior to construction	Contractor	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to TRAFFIC																		
Construction vehicles travelling on access roads towards the mine site	Footprint clearance	2	2	2	2	12	L	• Limit construction activities to the daytime; • Use establishment routes as far as possible; • Ensure that drivers obey all the rules of the road.	2	2	2	2	12	L	Compile work schedule for the construction phase activities including timeframes	Prior to construction	Contractor	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to VISUAL																		
Poor visibility due to dust creation	Footprint clearance	4	3	2	4	36	M	Implement dust suppression spraying where necessary.	2	3	2	2	14	L	Provide dust suppression equipment and water.	During construction	Contractor	Included in construction cost
Change to aesthetics of the landscape	Footprint clearance	4	4	2	4	40	M	Limit the clearance footprint as far as possible	4	3	2	2	18	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost

7.2.15.2 Establishment of Surface Infrastructure

At this stage it is anticipated that all surface infrastructure will be constructed during the construction phase. Should additional surface infrastructure be required, an EMP amendment will have to be compiled and the impacts thereof assessed. The impact assessment and proposed EMP are presented in Table 7.2.

Table 7.2 Mukulu Mine Construction Phase Impact Assessment and Management Plan: Establishment of Infrastructure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Construction Phase: Establishment of Surface Infrastructure																		
Issues related to TOPOGRAPHY																		
Change to natural topography	Establishment of Surface Infrastructure	6	3	2	3	33	M	• Detailed mine design must take cognisance of the natural topography; • Berms must be sloped to resemble the natural topography as far as possible; • Planting of trees and visual barriers where necessary; • Post-construction rehabilitation must be undertaken; • Clearly communicate rehabilitation plan must during induction training; • Rehabilitation to resemble the natural topography; and • Monitor post-construction rehabilitation.	4	3	2	2	18	L	Engineering and rehabilitation designs (of PDF and waste rock dump) to resemble the natural topography.	Prior to construction	Mining Engineer	Including in planning phase
															Planning for concurrent rehabilitation	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Monitor rehabilitated areas. Return to areas after 18 months to ensure rehabilitation has been successful	During and after construction	Environmental Control Officer	Included in construction cost
Issues related to GEOLOGY																		
None	Establishment Of Surface Infrastructure	4	5	1	5	50	M	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Soil compaction	Construction of infrastructure	2	4	6	4	48	M	• Keep infrastructure localized to reduce footprint; • When stripping machinery is used for stripping, stockpiling and 'topsoiling' operations, it should operate when the soil moisture content is below approximately 8 % (during the dry winter months) in order to limit soil compaction and machinery getting stuck; and • Tracked vehicles are more desirable than wheeled vehicles due to their lower point loading and slip, while vehicle speed should be maintained in order to reduce the duration of applied pressure, thereby	2	4	4	4	40	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Implement speed limits for all vehicles	During construction	Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost

Soil erosion	Construction activities and changes to the natural environment	1	5	8	4	56	M	• Keep as much original land cover as possible; • Erosion control measures such as intercept drains and toe berms must be constructed where necessary; • The width of the levelled or disturbed area for haul roads must be minimised as much as possible. Unnecessary dirt tracks (outside of the area to be disturbed) should not be formed during the construction of the haul road; • Gravel roads must be well drained; • The gravel haul road drainage system and surface must be well maintained; • The vegetative (grass) cover on the soil stockpiles (berms) must be continually monitored in order to maintain a high basal cover. Such maintenance will limit soil erosion by both the mediums of water (runoff) and wind (dust).	1	3	4	4	32	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Monitor rehabilitated areas. Return to areas after 18 months to ensure rehabilitation has been successful	During and after construction	Environmental Control Officer	Included in construction cost
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	H	• An intercept drain should be constructed upslope of the construction and operational areas, in order to re-direct clean water away from the area to avoid soil chemical pollution to clean groundwater resources. • An intercept drain should possibly be constructed downslope of the construction and operational areas, in order to drain potentially polluted water into a pollution control dam. • All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content. • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • Any failures to a dirty water system, e.g. sewage package plant must be managed immediately according to the Emergency Response Plant; • Contaminated soils must be managed as hazardous material.	1	3	4	4	32	M	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Provide spillkits at all sites	During construction	Contractor	Spillkit- R22 000
Change in natural landscape	Ground clearance and waste disposal	1	5	6	5	60	H	• Keep infrastructure to a minimum to reduce footprint; and • The soils stripped for levelling purposes must be stockpiled as a berm along the entire length of haul roads (upslope).	1	5	4	4	40	M	Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost

Issues related to WETLANDS																	
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected	Establishment of infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																	
Direct impacts on Red Data fauna species	Establishment of infrastructure	10	5	2	5	85	H	• No roads should be allowed within ecologically sensitive areas. The use of roads around ecologically sensitive areas for the purpose of buffers should be done with circumspect particularly in view of accidental killing of animals; • No animal may be hunted, trapped, snared or captured for any purpose whatsoever; • Fences and boundaries should be patrolled weekly in order to locate and remove snares/ traps; • Vehicular traffic should not be allowed after dark in order to limit accidental killing of nocturnal animals; • Speed of vehicles should be limited to allow for sufficient safety margins; • Dangerous animals should be handled by a competent person; Compile a graphic list of potentially dangerous animals and present this to all workers as part of site induction; • Sensitize all personnel to the presence, characteristics and behaviour of animals on the site; • Include suitable procedures in the event of encountering potentially dangerous animals on the site; • Ensure that a snake handler and/ or anti venom serum is available at all times, together with a competent person to administer this serum; and • No domestic pets should be allowed on the site.	10	5	3	2	36	M	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Implement speed limits for all vehicles	During construction	Project Manager	Included in construction cost
															Provide first aid kits at the construction site	During construction	Contractor/Project Manager	Included in construction cost
															Appoint competent person to be available for the handling of snakes during the construction phase	Prior to construction	Project Manager	Included in construction cost
Disruption of ecological connectivity and migration routes/ territorial infringements	Establishment of infrastructure	6	5	2	5	65	H	• Limit all impacts only to the approved development footprint, preventing all direct and indirect impact on areas of natural habitat situated adjacent to the approved footprint areas; • Implement a suitable buffer zone (at least 30m) between the edge of sensitive habitat and any type of development or surface disturbance; • Implement a suitable buffer zone around wetland habitat,	6	5	2	2	26	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost

								taking cognisance of recommendations from the wetland specialist; • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.							Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Direct impacts on common fauna species & interactions with structures & personnel	Establishment of infrastructure	6	4	2	4	48	M	• No roads should be allowed within ecologically sensitive areas. The use of roads around ecologically sensitive areas for the purpose of buffers should be done with circumspect particularly in view of accidental killing of animals; • No animal may be hunted, trapped, snared or captured for any purpose whatsoever; • Fences and boundaries should be patrolled weekly in order to locate and remove snares/ traps; • Vehicular traffic should not be allowed after dark in order to limit accidental killing of nocturnal animals; • Speed of vehicles should be limited to allow for sufficient safety margins; • Dangerous animals should be handled by a competent person; Compile a graphic list of potentially dangerous animals and present this to all workers as part of site induction; • Sensitize all personnel to the presence, characteristics and behaviour of animals on the site; • Include suitable procedures in the event of encountering potentially dangerous animals on the site; • Ensure that a snake handler and/ or anti venom serum is available at all times, together with a competent person to administer this serum; and • No domestic pets should be allowed on the site.	6	4	2	2	24	L	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Implement speed limits for all vehicles	During construction	Project Manager	Included in construction cost
															Provide first aid kits at the construction site	During construction	Contractor/Project Manager	Included in construction cost
															Appoint competent person to be available for the handling of snakes during the construction phase	Prior to construction	Project Manager	Included in construction cost
Issues related to FLORA																		
Loss or degradation of natural vegetation/ pristine habitat	Establishment of Surface Infrastructure	6	3	2	4	33	M	• Limit all impacts only to the approved development footprint, preventing all direct and indirect impact on areas of natural habitat situated adjacent to the approved footprint areas; • Implement a suitable buffer zone (at least 30m) between the edge of sensitive habitat and any type of development or surface disturbance; • Prevent contamination of surrounding areas of natural habitat, from stockpiling, conveyor lines, water	6	3	2	3	33	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile vegetation clearance plan	Prior to construction	Contractor/Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704	Prior to construction	Contractor/Project Manager	Included in construction cost

								treatment facilities or any other source of pollution;							of the NWA.			
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Direct impacts on ecological connectivity & ecosystem functioning	Establishment of Surface Infrastructure	6	4	2	4	36	M	• Limit all impacts only to the approved development footprint, preventing all direct and indirect impact on areas of natural habitat situated adjacent to the approved footprint areas; • Implement a suitable buffer zone (at least 30m) between the edge of sensitive habitat and any type of development or surface disturbance; • Implement a suitable buffer zone around wetland habitat, taking cognisance of recommendations from the wetland specialist; • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.	6	4	2	3	30	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Loss/ degradation of surrounding habitat	Establishment of Surface Infrastructure	6	3	2	4	44	L	• No roads should be allowed within ecologically sensitive areas. The use of roads around ecologically sensitive areas for the purpose of buffers should be done with circumspect particularly in view of accidental killing of animals.	4	3	2	2	20	L	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Increase in local and regional fragmentation/ isolation of habitat	Establishment of Surface Infrastructure	4	2	2	3	32	L	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • Demarcate construction areas by semi-permanent means/material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance.	4	2	2	1	10	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Increase in environmental degradation, pollution (air, soils, surface water)	Establishment of Surface Infrastructure	4	2	2	3	32	L	• Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance; • Prevent contamination of	4	2	2	1	10	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If	Prior to construction	Project Manager	Included in construction cost

								natural habitat from any source of pollution.							proved insufficient for control, these shall be replaced by fencing.			
Issues related to AIR QUALITY																		
Creation of dust	Establishment of Surface Infrastructure	4	2	2	3	24	L	• Demarcate construction footprint and limit activities to within this footprint as far as possible; • Keep as much original land cover as possible; • Rip and rehabilitate areas which have been disturbed and • Implement dust suppression spraying.	4	2	2	2	16	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Provide dust suppression equipment and water.	During construction	Contractor	Included in construction cost
															Implement air quality monitoring programme	Prior to construction	Environmental Coordinator with air quality specialist	R90 000
															Monitor rehabilitated areas. Return to areas after 18 months to ensure rehabilitation has been successful	During and after construction	Environmental Control Officer	Included in construction cost
Issues related to SURFACE WATER																		
Belgravia site: Existing animal watering pond removal	Establishment of shaft on Belgravia	2	2	2	2	12	M	Replace existing watering pond with new pond before it is removed	2	1	2	1	5	L	Appoint competent fauna specialist to advise regarding relocation of watering pond	Prior to establishment of Belgravia shaft	Environmental Coordinator	Included in operating cost
Contamination from dirty runoff	Establishment of shaft on Belgravia	2	2	2	2	12	L	Storm water Management Plan must be maintained during the life of the operation	2	1	2	1	5	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to GROUNDWATER																		
None	Establishment of Surface Infrastructure	2	5	1	3	24	L	None required	2	5	1	3	24	L	N/A	N/A	N/A	N/A
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Establishment of Surface Infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
Use of construction vehicles, hauling of building material to and from the construction site as well as the maintenance of equipment/machinery.	Establishment of Surface Infrastructure	4	2	1	3	21	L	• Limit construction activities to the daytime; • Ensure that vehicles are properly maintained; • When deciding on vehicles for the construction activities consider noise parameters; • Include noise reduction technology on vehicles where possible.	2	2	1	2	10	L	Compile schedule of construction activities	Prior to construction	Contractor	Included in construction cost
															Compile equipment maintenance and check schedule /monitoring schedule	Prior to construction	Contractor/Project Manager	Included in construction cost

Issues related to TRAFFIC																		
Construction vehicles travelling on access roads towards the mine site	Establishment of Surface Infrastructure	2	2	2	2	12	L	• Limit construction activities to the daytime. • Use establishment routes as far as possible; and • Ensure that drivers obey all the rules of the road. • Ensure an open channel of communication with the surrounding road users to act pro-activity on possible issues; • Consult with the relevant roads agency to determine whether the mine has to contribute to road maintenance or alterations due to increase traffic on the roads; • The access to the mine form the main roads will be designed in such a way as to fulfil the relevant roads agency requirements; and • Clear signage will be erected to warn road users of heavy vehicle presence.	2	2	2	2	12	L	Conduct general induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Erect signage at visible points along the access routes	Prior to construction	Project Manager	Included in construction cost
Issues related to VISUAL																		
Change to aesthetics of the landscape	Footprint clearance	4	4	2	4	40	M	Limit the clearance footprint as far as possible	4	3	2	2	18	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost

7.2.15.3 Shaft sinking and establishment of underground infrastructure

The development of access to the proposed underground mine on the farm Mukulu 265 will be undertaken during the construction phase. The other two shafts will be phased in over the life of mine. The impacts associated with the development of the shafts are presented in Table 7.3.

Table 7.3 Mukulu Mine Construction Phase Impact Assessment and Management Plan: Shaft Sinking and Establishment of Underground Infrastructure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Construction Phase: Shaft sinking and establishment of underground infrastructure																		
Issues related to TOPOGRAPHY																		
None	Establishment of mine access and ventilation shafts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
Alter red geology	Removal of underground material during mine access establishment	4	5	1	5	50	M	No mitigation measures are possible, as mining permanently destroys the geological strata. The mining operations will remain within the limits of the designated mining rights area.	4	5	1	5	50	M	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
None	Establishment of mine access and ventilation shafts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected. In addition, undermining of Pan 4 will occur at a depth of greater than 400 m and no surface subsidence is expected, thus no impact expected.	Establishment of mine access and ventilation shafts	0	0	0	0	0	L	None required	0	0	0	0		L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
None	Establishment of mine access and ventilation shafts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FLORA																		
Increase in invasive species due to the presence of activities in the area	Establishment of underground mine	6	5	2	4	52	M	• A detailed weed management programme will be established and enforced on the mine; • Local labour will be utilised for the removal of weeds; • The monitoring of invasive species will be undertaken on a scheduled timeframe and will be allocated to a specific responsible person	4	4	2	3	30	L	Compile weed/alien plant eradication programme.	During construction	Environmental Coordinator	Included in construction cost
															Implement a weed and alien invasive species eradication programme during the life of the mine all areas. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings.	Monthly	Environmental Coordinator	R 22 000
Issues related to AIR QUALITY																		
Creation of dust	Establishment of access shaft	4	2	2	3	24	L	Implement dust suppression spraying where necessary.	4	2	2	2	16	L	Provide dust suppression equipment and water.	During construction	Contractor	Included in construction cost
Issues related to SURFACE WATER																		
Contamination from dirty runoff	Construction	2	2	2	2	12	L	Storm water Management Plan implemented before construction	2	1	2	1	5	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of	Prior to construction	Contractor/Project Manager	Included in construction cost

							L							L	the NWA.			
Issues related to GROUNDWATER																		
Groundwater will be intersected during the construction of shafts. Dewatering will take place to ensure a safe working environment. Result is the dewatering of the groundwater systems in the immediate vicinity of shafts.	Shaft Dewatering	2	5	1	3	24	L	• Groundwater monitoring programme must be implemented immediately and the groundwater model must be up dated as soon as new information become available; • It is recommended that groundwater monitoring is undertaken prior to the construction phase to establish the baseline conditions of the local groundwater resource; • Predicative modelling will help to determine if any groundwater users will be negative impacted; • Water from dewatering to be stored in dirty water dam for reuse during dust suppression; • The mine will ensure that the necessary water use licenses are in place prior to undertaking dewatering activities.	2	5	1	3	24	L	Implement groundwater monitoring programme	Monthly	Environmental coordinator and groundwater specialist	R 160 000
Issues related to HERITAGE AND ARCHAEOLOGY																		
Heritage - graves sites 2,3 and 6	Blasting and dust	10	4	2	4	64	H	Implement Heritage Management Plan	6	4	2	2	16	L	Appoint heritage expert to compile heritage management plan	Prior to construction	Project Manager	R40 000 - once off
Heritage - buildings sites 1, 4, 5, 7, 8, 11	Blasting and dust	10	4	2	4	64	H	• Implement Heritage Management Plan for site 1. • Monitor the remaining sites.	2	4	2	2	16	L	Appoint heritage expert to compile heritage management plan	Prior to construction	Project Manager	R40 000 - once off
															Monitor sites within a 1km radius of the blasting sites	After blasting takes place	Environmental Control Officer	Included in construction costs
Issues related to NOISE																		
Creation of noise	Establishment of mine access and ventilation shafts	6	2	2	4	40	M	• Restrict blasting to the day; • Landowners and residents in the vicinity of the blasting activities should be warned prior to blasting.	4	2	2	2	16	L	Develop landowner/community forum to communicate with landowners and occupiers of adjacent properties prior to blasting	Prior to construction	Project Manager	Included in construction costs
Issues related to TRAFFIC																		
None	Establishment of mine access and ventilation shafts	0	0	0	0	0	L	• Undertake blasting during the day • Inform landowners and tenants within and around mining area before blasting takes place.	0	0	0	0	0	L	Establish landowner forum/environmental committee to communicate with I&APs	Prior to construction	Community liaison officer	Included in construction costs
Issues related to VISUAL																		
None	Establishment of mine access and ventilation shafts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.2.15.4 Waste Handling

The impacts associated with the handling and disposal of waste created during the construction phase is presented in Table 7.4.

Table 7.4 Mukulu Mine Construction Phase Impact Assessment and Management Plan: Waste Handling

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Construction Phase: Waste Handling																		
Issues related to TOPOGRAPHY																		
None	Waste Handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
None	Waste Handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	H	• Solid waste must be stored at site on an approved waste disposal area, or removed by credible contractors; • An intercept drain should be constructed upslope of the construction and operational areas, in order to re-direct clean water away from the area to avoid soil chemical pollution to clean groundwater resources; a • An intercept drain should possibly be constructed downslope of the construction and operational areas, in order to drain potentially polluted water into a pollution control dam; • Any spillages from a wastewater system, e.g. the sewage package plant must be managed immediately in accordance with the Emergency Response Plan.	1	3	4	4	32	M	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Provide spillkits at all area on site	During construction	Contractor	Spillkit- R22 000
Chemical soil pollution	Spillage of used hydrocarbons or chemicals	8	2	2	5	60	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site; • Contaminated soils must be managed as hazardous	4	2	2	4	32	M	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Provide spillkits at all area on site	During construction	Contractor	Spillkit- R22 000

								material; • Accidental spillage must be minimised and contained; • The spilled substance must be collected and stored in a suitable container in a bunded area; • Determine the depth and width that the oil/diesel has penetrated into the soil as far as possible, by digging up the polluted soil (excavating); and • Remove the polluted ground to one side and mix it thoroughly with the bioremediation powder; • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.							Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Control Officer	Included in construction costs
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected. The distance between the surface disturbances and the wetlands will provide for a sufficient buffer between any pollutants that might enter the environment and the pans on site.	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A			
Issues related to FAUNA																		
Death of fauna	Poor management of domestic waste which may attract scavengers	8	4	2	5	70	H	• A clearly defined waste management system will be put in place; • Waste disposal areas will be placed strategically and easily accessible on site; • Waste recycling will be enforced on site; • Heavy penalties must be enforced for littering on site.	4	4	2	2	20	L	Develop Environmental Management System for construction phase	Prior to construction	Environmental Coordinator	Included in planning costs
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to FLORA																		
Direct impacts on flora species	Spillage of used hydrocarbons or chemicals	8	4	2	5	70	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals	4	4	2	2	20	L	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Provide spillkits at all area on site	During construction	Contractor	Spillkit- R22 000

								stored on site. • Accidental spillage must be minimised and contained; • The spilled substances must be collected and stored in a suitable container within a bunded area; • Contaminated soils must be managed as hazardous material; • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained; • Contaminated soils must be treated as a hazardous material and stored in suitable containment; • The contaminated soil must be treated with bioremediation agents; • The soil must be monitored on a daily basis until remediation is considered successful.							Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Control Officer	Included in construction costs
Issues related to AIR QUALITY																		
None	Establishment of mine access and ventilation shafts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SURFACE WATER																		
Contamination from dirty runoff	Stockpiling	2	2	2	2	12	L	• Storm water Management Plan must be implemented before construction. • All activities should remain in the dirty water areas of the mine.	2	1	2	1	5	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to GROUNDWATER																		
Negative impact on groundwater quality from fuel & oil spillage. Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate of the groundwater system.	Waste Handling/Fuel Spillage	4	2	1	3	21	L	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site. • Accidental spillage must be minimised and contained; • The spilled substances must be collected and stored in a suitable container within a bunded area; • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is	2	2	1	2	10	L	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Provide spillkits at all area on site	During construction	Contractor	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Control Officer	Included in construction costs

								minimized and contained. • Contaminated soils must be treated as a hazardous material and stored in suitable containment; • The contaminated soil must be treated with bioremediation agents; • The soil must be monitored on a daily basis until remediation is considered successful.										
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
None	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
Negative impact on aesthetic quality of the areas	Incorrect storage and handling of domestic waste	6	4	2	4	48	M	Solid waste must be stored at site on an approved waste disposal area, or removed by credible contractors.	4	4	2	2	20	L	Appoint contractor to remove domestic waste from the site on a weekly basis	Prior to construction	Project Manager	Included in construction cost

7.2.15.5 Cumulative Impacts

Cumulative impacts will be created due to the presence of the existing Assmang Black Rock mine adjacent (to the north of) the proposed Mukulu Mine. The cumulative impact assessment and EMP is presented in Table 7.5.

Table 7.5 Mukulu Mine Construction Phase Impact Assessment and Management Plan: Cumulative Impacts

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S					M	D	S	P	TOT	SP				
Construction Phase: Cumulative Impacts																		
Issues related to TOPOGRAPHY																		
Change to topography of the larger area	Surface infrastructure in close proximity to existing Assmang Black Rock Mine	4	5	2	3	33	M	• Detailed mine design must take cognisance of the natural topography; • Berms must be sloped to resemble the natural topography as far as possible; • Planting of trees and visual barriers where necessary; • Post-construction rehabilitation must be undertaken; • Clearly communicate rehabilitation plan must during induction training; • Rehabilitation to resemble the natural topography; and • Monitor post-construction rehabilitation.	4	5	2	2	22	L	Engineering and rehabilitation designs (of PDF and waste rock dump) to resemble the natural topography.	Prior to construction	Mining Engineer	Including in planning phase
															Planning for concurrent rehabilitation	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost
															Monitor rehabilitated areas. Return to areas after 18 months to ensure rehabilitation has been successful	During and after construction	Environmental Control Officer/Environmental Coordinator	Included in construction cost
Issues related to GEOLOGY																		
Alterered geology	Underground mining at Mukulu and the existing adjacent, Assmang Black Rock Mine	4	5	1	5	50	M	No mitigation measures are possible, as mining permanently destroys the geological strata. The mining operations will remain within the limits of the designated mining rights area.	4	5	1	5	50	M	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Change to land capability of the disturbed areas	Permanent change to soil structure	6	4	2	4	48	M	• The construction footprint should be kept as small as possible; • Keep as much original land cover as possible; • The majority of stripped soils should be stockpiled as a berm upslope surrounding the disturbed area; • Soil stockpiles must be sampled, ameliorated (fertilized) and re-vegetated as soon after construction as possible. This is in order to limit raindrop and wind energy, as well as to slow and trap runoff, thereby reducing soil erosion. Grassland and shrub species indigenous to the area are preferred.	4	4	2	2	20	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost
															Compile post-construction rehabilitation plan	Prior to construction	Environmental Coordinator	Included in construction cost
															Manage spillages according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage
															Undertake monitoring of rehabilitated areas	At least four (4) After rehabilitation or remediation	Environmental Control Officer/Environmental Coordinator	Included in construction cost
Issues related to WETLANDS																		

No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, so the project will not contribute to any further wetland loss.	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A	
Issues related to FAUNA																			
Impacts on SA's conservation obligations & targets	Clearance of vegetation and movement on site	4	4	2	2	20	L	• Limit the development footprint of the proposed development as far as possibly, ensuring the preservation of as much as possible medium-high floristic sensitivity areas; • Demarcate construction areas by semi-permanent means/material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts; • Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance.	4	4	2	1	10	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	Included in construction cost	
Issues related to FLORA																			
Loss of floral diversity	Proliferation of alien invasives	8	5	2	5	75	H	• A detailed weed management programme will be established and enforced on the mine; • Local labour will be utilised for the removal of weeds; • The monitoring of invasive species will be undertaken on a scheduled timeframe and will be allocated to a specific responsible person	8	5	3	2	32	M	Compile weed/alien plant eradication programme.	During construction	Environmental Coordinator	Included in construction cost	
															Implement a weed and alien invasive species eradication programme during the life of the mine all areas. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings.	Monthly	Environmental Coordinator	R20 000	
Issues related to AIR QUALITY																			
Creation of dust	Construction phase dust creation adding to existing impacts cause by Black Rock Mine	6	2	2	4	40	M	• Demarcate construction footprint and limit activities to within this footprint as far as possible; • Keep the clearance area as small as possible; and • Keep as much original land cover as possible; Implement dust suppression spraying where necessary; • Implement dust suppression spraying.	4	2	2	2	16	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Project Manager	In
															Implement air quality monitoring programme	Prior to construction	Environmental Coordinator with air quality specialist	R90 000	
															Provide dust suppression equipment and water.	During construction	Contractor	Included in construction cost	
Issues related to SURFACE WATER																			
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A	
Issues related to GROUNDWATER																			
Negative impact on groundwater quality from fuel & oil spillage	Fuel Spillage	2	4	2	2	16	L	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas;	2	4	2	1	8	L	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in construction cost	

								• In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site; • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained; • The spilled substance must be captured and stored in a suitable container within a bunded area; • Determine the depth and width that the oil/diesel has penetrated into the soil as far as possible, by digging up the polluted soil (excavating); and • Remove the polluted ground to one side and mix it thoroughly with the bioremediation powder; • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.							Provide spillkits at all area on site	During construction	Contractor	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Control Officer/Environmental Coordinator	Included in construction costs
Deeper aquifers are already dewatered to a certain extent due to existing neighbouring mining activities.	Mine Dewatering	6	5	2	4	52	M	• The groundwater monitoring programme must be implemented immediately and groundwater model must be up dated as soon as new information becomes available; and • Predicative modelling will help to determine if any groundwater users will be negative impacted. • A water forum should be established that will involve the farmers, municipality, mines in the area and the DWA	2	5	1	3	24	L	Implement groundwater monitoring programme	Monthly	Environmental coordinator and groundwater specialist	R 160 000
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
Change to aesthetics of the area	Mine development next to existing Assmang Black Rock Mine	2	4	2	2	16	L	Limit construction footprint as far as possible.	2	4	2	2	16	L	N/A	N/A	N/A	N/A

7.2.15.6 Socio-economic Impacts

The socio-economic impacts associated with the construction phase of the project and the proposed EMP is presented in Table 7.6.

Table 7.6 Mukulu Mine Impact Assessment and Management Plan: Socio-Economic Impacts

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Issues related to SOCIO-ECONOMIC ENVIRONMENT																		
Construction Phase: Social Change Process: Demographic processes																		
Increase in population size		8	4	3	4	60	H	• Employment criteria should be communicated to the community in advance (e.g. in newspapers, community forum notice boards, etc); • Local labour should be used as far as possible; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; • The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Temporary staff should be housed in the surrounding communities, i.e. Bed and Breakfast establishments, etc. to prevent the establishment of construction camps; and • The AgriSA protocol for access to farms should be followed at all times.	3	8	4	3	45	M	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
															Verify the details of potential employees in order to ensure that local labour is employed.	Prior to construction	Project Manager	Included in construction and planning costs
Effect of temporary workers on social dynamics		6	3	3	3	36	M	• Chemical latrines or ablution facilities must be provided to workers in close proximity to the site; • Employ local labour as far as possible (within a 80 km radius); • Avoid the establishment of camps, hostels or temporary accommodation for workers. Accommodation should be provided at suitable locations in Kuruman, Kathu and surrounds; and • Ensure that during the project construction process and the operational phase of the project, employees receive adequate health support from the project team for work-related health problems.	4	3	3	3	30	L	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs

Construction Phase: Social Change Process: Economic processes																	
Waged labour		6	3	3	4	48	M	• Unskilled and unemployed labour should be sourced from the surrounding local communities as far as possible; • Skills development opportunities should be granted to community members and local job seekers, where needed; • Maximise employment opportunities for the local communities and reduce the influx of a foreign labour force whilst ensuring an effective construction and operational phase; • Make use of any existing skills databases and include the local councillors and other representative community structures in the process; • Identify and maximise on appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force during the pre-construction, during construction and during full operation. It is recommended that training and skills development activities start during the construction period; • Ensure that local businesses, especially those of Historically Disadvantaged Individuals (HDI), women and of Small, Micro and Medium Enterprises (SMMEs) get allocated the maximum appropriate share of project related business opportunities; and • Ensure that the Labour Relations Amendment Act, 2002 (Act No. 12 of 2002) as well as the necessary policies and procedures are taken into consideration to ensure the correct procurement procedures.	6	3	3	3	36	M	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
															Project contracts between the mine and the main contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks;	Prior to construction	Project Manager	Included in construction and planning costs
															Establish an employment information desk to assist with the day to day management of project related labour issues;	Prior to construction	Human Resources Manager	Included in construction and planning costs
															Develop a Recruitment Manual to include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on procedures to be followed by aspiring employment seekers.	Prior to operation	Human Resources Manager	Included in construction and operational costs
															Capture all project relevant skills in the project area with the aim to ensure maximum local employment;	Prior to operation	Human Resources Manager	Included in construction and operational costs
Conversion and diversification of economic activities		4	3	3	3	30	L	• Affected landowners must be consulted to establish means to continue farming practises, i.e. as part of a Local Economic Development project to supply the mine with produce; • Economic development should take place in line with the Local Municipality's IDP, as well as their Spatial Development Framework; and • The establishment of new businesses should comply with zoning and local by-law requirements.	6	3	3	3	36	M	Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs

Employment creation and decrease in unemployment		4	3	3	3	30	L	• It is suggested that non-locals should only be hired when specialist skills, which are not available locally, are required and local business providing such skills cannot be created. The following aspects in this regard should receive priority: • Labour based construction methods should be used whenever practically possible; • Local residents and communities should be employed, wherever possible; • Local construction companies should be used whenever possible, especially for subcontracting work; and • Local suppliers should be used as far as possible.	6	4	3	3	39	M	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
															Develop procurement policy for mine	Prior to construction	Mine management team	Included in construction and planning costs
Construction Phase: Social Change Process: Geographic processes																		
Conversion and diversification of land use		6	4	3	4	52	M	• Educate landowners in terms of their rights and responsibilities prior to the project going ahead; • Integrate the mining area with regional land use planning objectives where possible; and • Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options.	4	4	3	4	44	M	Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs
Transportation and rural accessibility		4	4	3	2	22	L	• Employ local labour as far as possible to limit the negative impacts on the infrastructure and services within the area (e.g. roads); • Speed limits on the local roads surrounding the mining site should be enforced; and • Appropriate traffic management measures should be planned for and implemented, especially during the construction phase with the expected increase in heavy vehicle traffic.	6	4	3	3	39	M	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
															Assist the relevant Roads and Traffic Department; assist with the regular maintenance of the roads frequently used by construction and mine traffic.	Ongoing	Mine Management	Included in construction and operating costs
Construction Phase: Social Change Process: Emancipatory and empowerment processes																		
Capacity building (skills transfer)		6	2	3	4	44	M	• Recruit and train local residents to supply unskilled labour during the construction and operational phase; • The use of diverse activities should be stimulated, allied with, but not reliant on, construction related activities such as outsourcing catering activities to local businesses.	8	3	3	4	56	M	Develop a Recruitment Manual to include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on procedures to be followed by aspiring employment seekers.	Prior to operation	Human Resources Manager	Included in construction and operating costs

								The local municipality could assist local residents and business owners to garner the benefit associated with the spin-offs emanating from the proposed mine; • Stakeholders should be mutually accountable for increased opportunities regarding skills and competency development (general education and technical training). • Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere; • The project implementers and/or the contractors should identify the required jobs to be undertaken prior to the construction phase to enable local recruitment and/or some form of basic training; • Ensure that stakeholders have knowledge of the support of legislation and regulations; • Ensure compliance to the BBSEC and MPRDA; and • Ensure that the employment and training of HDSA and women meet the requirements of the BBSEC.							Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs
Construction Phase: Social Change Process: Socio-cultural processes																		
Deviant social behaviour		6	3	2	3	33	M	• Require mine personnel to wear identification badges to distinguish them from trespassers or unwanted loiterers; • Liaise with the SAPD in order to implement effective crime prevention strategies; and • Liaise with existing forums in the community to communicate information to the community and to assist in the monitoring of compliance.	6	2	2	3	30	L	Establish a code of conduct for construction and mine workers with strict control measures.	Prior to operation	Human Resources Manager	Included in construction and operating costs
															Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs
Actual health		6	3	3	4	48	M	• In order to reduce the impact on the local community it is important to maximise the use of local labour as far as possible; • Local labour should be employed as far as possible to avoid additional pressure on the existing services; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • The necessary safety precautions should be taken and first aid supplies should be made available on site;	4	3	3	4	40	M	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
															Develop a Recruitment Manual to include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on procedures to be followed by aspiring employment seekers.	Prior to operation	Human Resources Manager	Included in construction and operating costs

								• All mine employees (including contractors) should undergo health and safety training on a regular basis; • The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services; and • The required safety equipment should be provided to employees as well as on site and should be in a good working order.							Ensure compliance with the management measures in the approved EMP	During construction	Environmental Coordinator/Project Manager/Contractor	Included in construction and operating costs
															Conduct environmental induction for workers	Prior to construction	Project Manager/Contractor	Included in construction costs
Perceived health (prior to construction)		8	5	2	4	60	H	• Boreholes on the affected farms, as well as surrounding farms where possible should be monitored for water quality and quantity; • Sufficient safety precautions should be put in place to limit the exposure of hazards such as dust to mine workers; and • Continuous communication with affected landowners and community members should take place, informing them of the various mitigation measures put in place to limit the impact on them.	4	2	2	2	16	L	Ensure compliance with the management measures in the approved EMP	During construction	Environmental Coordinator/Project Manager/Contractor	Included in construction and operating costs
															Conduct groundwater monitoring	Monthly- starting prior of construction	Environmental Coordinator and groundwater specialist	R 160 000
															Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs
Feelings in relation to the project		6	3	3	3	36	M	• A comprehensive PPP should be implemented to effectively consult and involve the affected landowners and communities; • Continuous consultation with the affected communities should take place to keep them informed; • Consultation with the surrounding residents should take place on a continuous basis to understand, assess and mitigate their concerns where appropriate; • The mine must be transparent about the areas they intend mining and the proposed mining method and technology; and • Information about the proposed mining methods should be made available to stakeholders to educate them about mining in general as well as the proposed mining methods.	6	2	3	2	22	L	Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs
Physical quality of the living environment		10	4	2	4	64	H	• Existing community forums must serve as liaison between the affected stakeholders and the mine and can discuss traffic, dust, noise and construction related concerns with them; • Apply environmental management measures as per the approved EMP • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to	8	4	2	3	42	M	Ensure compliance with the management measures in the approved EMP	During construction	Environmental Coordinator/Project Manager/Contractor	Included in construction and operating costs

								limit exposure. Drilling and blasting should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts.										
Aesthetic quality of the living environment		6	4	2	4	48	M	• The design and specific positioning of the infrastructure should aim to minimise the possible negative visual impact of the mine on the surrounding property owners; • The design of the mine buildings should blend in with surrounding environment; and • Recycle dumps or use as backfill with appropriate permission.	4	4	2	4	40	M	Design mine with the aim of reducing environmental and visual impacts	Prior to construction	Mine Engineer	Included in planning costs
Availability and quality of housing		8	4	3	4	60	H	• Employees should be educated with regards to their accommodation options; • Housing needs should be monitored and addressed in consultation and cooperation with the applicable LMs; and • Maximise the employment of locals to limit the need for any additional housing infrastructure, as far as possible.	8	4	3	3	45	M	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
Adequacy of physical infrastructure		8	4	3	4	60	H	• The provision of infrastructural services must be integrated with the economic needs of the community; • The client, in liaison with the municipality should proactively plan for enough infrastructure and services to meet the maximum potential of the mine in terms of service and infrastructure demand; • Measures must be taken to address infrastructure development as part of future planning; • The relevant authorities, and bodies involved in the supply of bulk services should be informed about the proposed project to ensure that it gets incorporated into their demand	6	4	3	3	39	M	Ensure that the needed public services and capital facilities are in place before the peak construction occurs.	Prior to construction	Mine Management	Included in planning costs

								projections; • Promote local procurement of suppliers and contractors for the transport system.										
Adequacy and access to social infrastructure		6	3	2	3	33	M	• Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations; • Continuous involvement of the mine would be necessary and should be undertaken in a transparent and supportive manner; • Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus; • Communication of the projects that the mine would be involved in should filter through to all community levels to ensure maximum benefit to the community; and • Community development projects initiated by the mine should avoid benefiting only a selected few but should follow a broad based approach, whilst also taking budgeting constraints into consideration.	8	4	2	4	56	M	In consultation with the municipality and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine, take place.	Prior to construction	Mine Management	Included in planning costs
Personal safety and hazard exposure		6	4	2	4	48	M	• Local, unemployed labour should be employed as far as possible; Accommodation for members of the workforce, other than security personnel, must not be permitted on site; • The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Strict security measures should be put in place. Security personnel should be on site on a permanent basis; • Construction workers should be confined to the construction area and should wear uniforms or identity tags to be easily identified; • The mining area should be fenced to avoid unauthorised entry by humans or animals onto the mining area; • The contractor should communicate the construction schedule and vehicle	4	4	2	3	30	L	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs

								movements to the neighbouring property owners in advance; • Workers must not be allowed to overnight on the premises and must be transported to their places of residence by bus on a daily basis; • Workers must not be allowed to leave the designated mining areas without permission; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • The applicant should, in conjunction with the property owners, develop and implement emergency procedures; • Operational safety risks should be addressed as part of the OHS Act; • A Fire/Emergency Management Plan should be developed and implemented. It is important that this management plan and associated communication channels are developed at the outset of the construction phase. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams, mine management and neighbouring landowners;							A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses;	During construction	Project Manager	Included in construction and planning costs

								• Open fires for cooking and related purposes should not be allowed on site; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • The construction sites should be clearly marked and “danger” and “no entry” signs should be erected; • Speed limits on the local roads surrounding the construction sites should be enforced; and • Speeding of construction vehicles must be strictly monitored.										
															Conduct induction for workers	Prior to construction	Contractor/Project Manager	Included in construction costs
Crime and violence		4	3	3	2	20	L	• Local, unemployed labour should be employed as far as possible; • The applicant must liaise with the LMs and labour unions to establish a protocol for ensuring community safety; • Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body; and • The AgriSA protocol for access to farms should be followed in all instances where access to farmers’ land is required.	4	2	3	2	18	L	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
Functioning of government agencies		6	3	3	3	36	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programme.	8	4	3	4	60	H	Institute a joint municipal coordinating and implementing committee to support the municipality’s local economic and social develop needs and requirements, where feasible.	During operation	Mine Management	Included in construction and planning costs

Impact equity		4	2	3	3	27	L	• Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution). Mitigation measures from the specialist studies dealing with these issues should thus be strictly implemented; • Safety and security measures are critical to avoid any increase in criminal activities within the local study area; • Skills training and development should be maximised to benefit as many local employees as possible; and • The use of local labour must be maximised as far as possible.	8	4	3	3	45	M	Ensure compliance with the management measures in the approved EMP	During construction	Environmental Coordinator/Project Manager/Contractor	Included in construction and operating costs
															Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
Gendered division of labour		4	3	3	2	20	L	• Women must have equal employment opportunities; • Training and skills development should take place for women; • Salaries of women should be equal to that of men when undertaking the same job; • Commitments made in the SLP with regard to the employment of women should be adhered to.	6	4	3	3	39	M	Institute a well designed gender equality strategy on the mine.	During all phases of the mine life cycle	Humana Resources/Mine Management	Including in construction and operating costs

7.3 Operational Phase

This section comprises of the description of potential impacts associated with the proposed operation of the mine on the biophysical, socio-economic and heritage and cultural environment. These descriptions are followed by the impact tables which contain the assessment of the significance of each identified impact without, then with mitigation measures. Each mitigation measure proposed is assigned a proposed action plan, frequency, associated management cost, as well as person responsible for implementation of the mitigation measures proposed to mitigate and/or manage each impact.

7.3.1 Topography

The location of the proposed surface infrastructure above the proposed underground mine (ore body) poses the risk of subsidence. This risk cannot be quantified at this stage. It is recommended that a Geotechnical Investigation is commissioned prior to the start of construction to determine and quantify the risk.

7.3.2 Geology

The geology of the area will be impacted on due to underground mining within the Mukulu Mine MRA and at the adjacent Black Rock Mine. Although this impact is expected to be of medium significance, no mitigation is possible as mining permanently impacts on the geological strata. The mining activities will, however, remain within the mining right area.

7.3.3 Groundwater

The operational phase activities will impact on groundwater quantity and quality. The extent and significance of these impacts over time was determined using a groundwater numerical model. The model calculated the project mine inflow volumes as well as the contaminant transport within the groundwater resource.

The description of the groundwater model boundaries, assumption, limitations, input, etc. can be found under Chapter 6 of the Hydrogeological Report under Appendix B- 2 of this report.

7.3.3.1 Groundwater quantity

Model simulations calculated the expected inflow volumes into underground operations for the next 20 years of mining (it should be noted that once the mine commence, the groundwater model will be continuously updated with accurate and mining specific information), as well as the expected dewatering cone that would develop within the deeper aquifers. The modelled inflow volumes are mainly controlled by:

- Area of mined-out workings – the larger the area, the higher the chance of intersecting water-bearing fractures;
- Depth of underground workings – the frequency of aquifer intersection becomes less with depth. Groundwater inflow is therefore higher in the shallow parts; and
- Known potential preferential groundwater paths such as dykes and faults. In secondary aquifer environments, groundwater inflow volumes are dominated by the frequency and hydraulic parameters of these fractures.

The predicted inflow volumes (m^3/d) into the underground workings for the Mukulu Mine are summarized in Table 7.7.

Table 7.7 Predicted inflow volumes (m^3/d) into underground operations

Year	Inflow Volume (m^3/d)
1	102
2	80
3	84
4	106
5	114
6	125
7	147
8	150
9	161
10	164
11	165
12	163
13	158
14	164
15	163
16	179
17	175
18	172
19	167
20	156

Dewatering will take place during the operational phase of mining to ensure a safe working environment. This will cause dewatering of the surrounding aquifers, and a subsequent drawdown in groundwater levels. Aquifers will supply groundwater at varying fluxes according to relative hydraulic gradients and conductance.

The extent and shape of the drawdown cone will be influenced by the geological and hydrogeological characteristics of the area. Due to the very low transmissivity of the rock material, the lateral extent of the drawdown is limited and will display steep gradients. The opposite will be true for the higher transmissivities associated with the faults and fracture zones, where the extent of dewatering might be further and the gradients shallower.

The dewatering of the proposed underground mine development was simulated using drain nodes. These nodes allow for the setting of a reference level to which the mining area will be dewatered over a specified time period. The results of the flow model dewatering simulations for the next 20 years can be viewed in Figure 7.1.

The resultant drawdown in groundwater levels is not expected to affect any groundwater users in the area neighbouring the Mukulu Mine. These inflow volumes must be seen as average values that may vary by about 20%. No mine water decanting is expected to occur after mining operations have stopped and underground operations are allowed to flood during the decommissioning and closure phases.

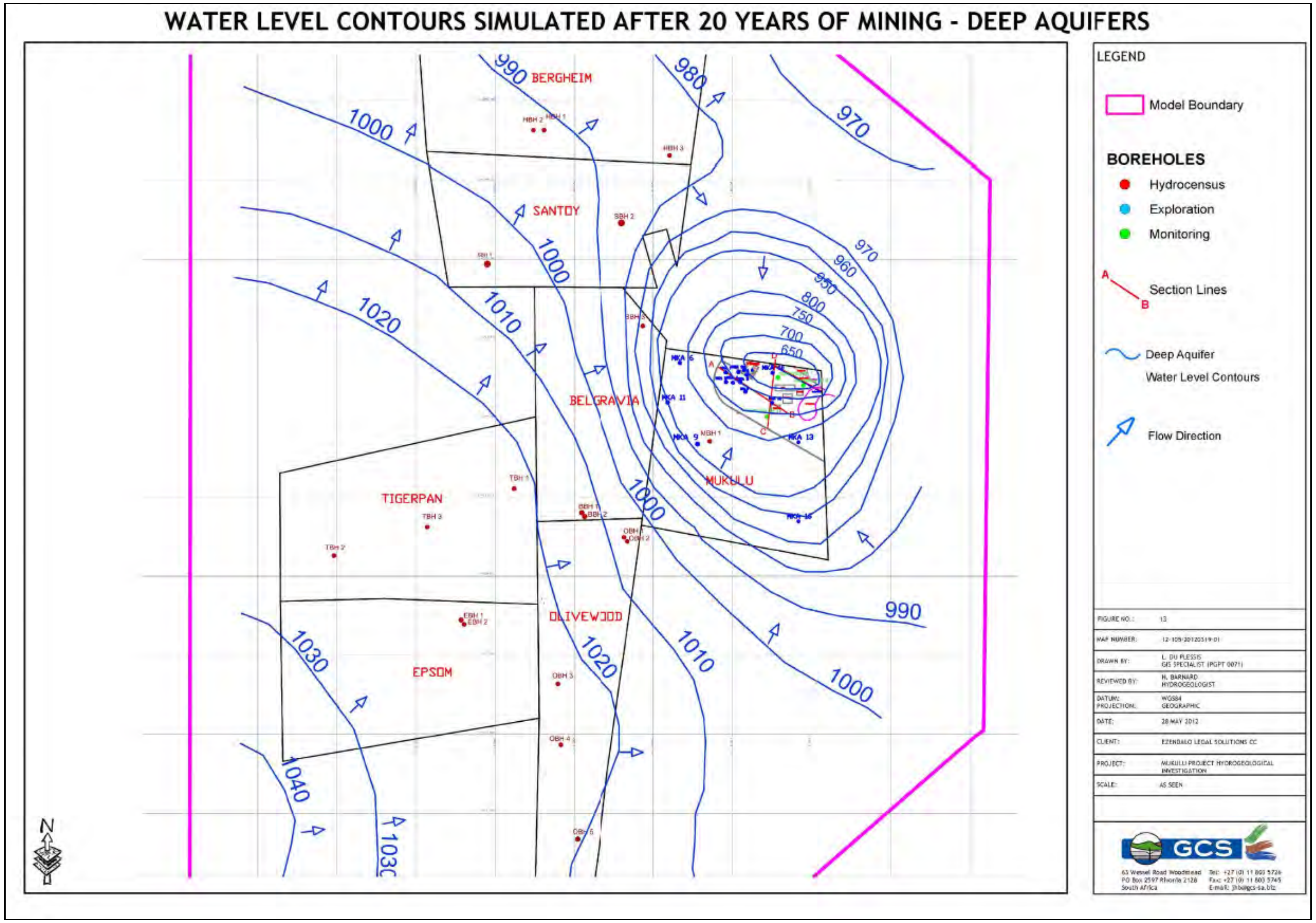


Figure 7.1 **Water level contours simulated after twenty years of mining - deep aquifers**

7.3.3.2 Groundwater quality

Based on geochemical analyses, no significant contaminant plumes are expected. Nevertheless, for risk assessment purposes, nitrate (NO_3 as N) was selected as a potential contaminant for the transport model simulation runs. Nitrate originates from residues of explosives, used for underground blasting. Nitrate concentrations as high as 150 mg/l were selected as the worst case scenario for pollution from these areas.

Most contamination of the groundwater systems is expected from the PDF and stockpile areas. However, this can be mitigated by keeping these areas as dry as possible and minimising infiltration of rainwater. This is best achieved through dirty and clean water separation. The underground workings should be kept as dry as possible to ensure a safe mining environment. Therefore, no contamination of aquifers is expected from the underground mine during this phase.

With the absence of sulphide in the host rock, the potential of Acid Mine Drainage is considered low at this stage. Nitrate (NO_3 as N) was selected as the main contaminant for the transport model simulation. Nitrate originates from residues of explosives, used for underground blasting.

Two scenarios were simulated with the aid of the groundwater model to determine how far the contaminant flow will extend from the PDF and which flow directions it will follow. In both scenarios it was assumed that the PDF will not be underlined, with some form of impermeable liner:

- **Scenario 1:** Scenario 1 represents average conditions. A starting mass concentration of 50mg/l was used for the Slimes Dam area. Basin seepage losses through the basin of the Slimes Dam were taken at 50mm/year per m2 or 7m3/day. This is a very conservative value if compared to the average for the industry which varies between 50 – 200mm/year. The expected contamination plumes after 20 years are shown graphically in Figure 7.2.
- **Scenario 2**: Scenario 2 represents a worst-case scenario. A starting mass concentration of 150mg/l was used for the Slimes Dam Area. Basin seepage losses through the basin of the Tailings Dam were taken at 70mm/year per m2 or 10m3/day. The expected contamination plumes after 5 years are shown graphically in Figure 7.3.

The potential contaminant plume is likely to be confined to the surface infrastructure area. No groundwater users are likely to be impacted.

7.3.3.3 Impact on surface water due to groundwater impacts

The proposed underground mining activities of the Mukulu Mine are expected to have no impact on streams or other surface water bodies.

7.3.3.4 Recommendations

- It is recommended that the flow and mass transport model be re-calibrated and updated every year with updated monitoring data. The current mass transport model must be regarded as preliminary due to the lack of proper piezometric data. During the closure phase, a better understanding of the local aquifer conditions will be developed and more reliable long-term predictions can be made;
- With this investigation is was proven that a shallower aquifer with a perched water level, as well as deeper aquifers with a deeper water level, exist. The lateral extent of both aquifers and the dewatering cone that has developed due to the cumulative dewatering activities of all mines in the area, have not been determined yet. It is therefore recommended that a regional groundwater study is undertaken in this regard;
- A groundwater monitoring programme must be implemented as soon as possible;
- The water volumes pumped from underground and on surface should be monitored and well documented;
- The water control dams should be designed such that they can easily contain a 1:50 year flood;
- The slimes dam floor area should be underlined to prevent any vertical infiltration into the underlying aquifers; and
- Fuel tanks and any fluid container areas should be properly constructed with cement or concrete flooring to prevent infiltration of any spilled fluids into the soils.

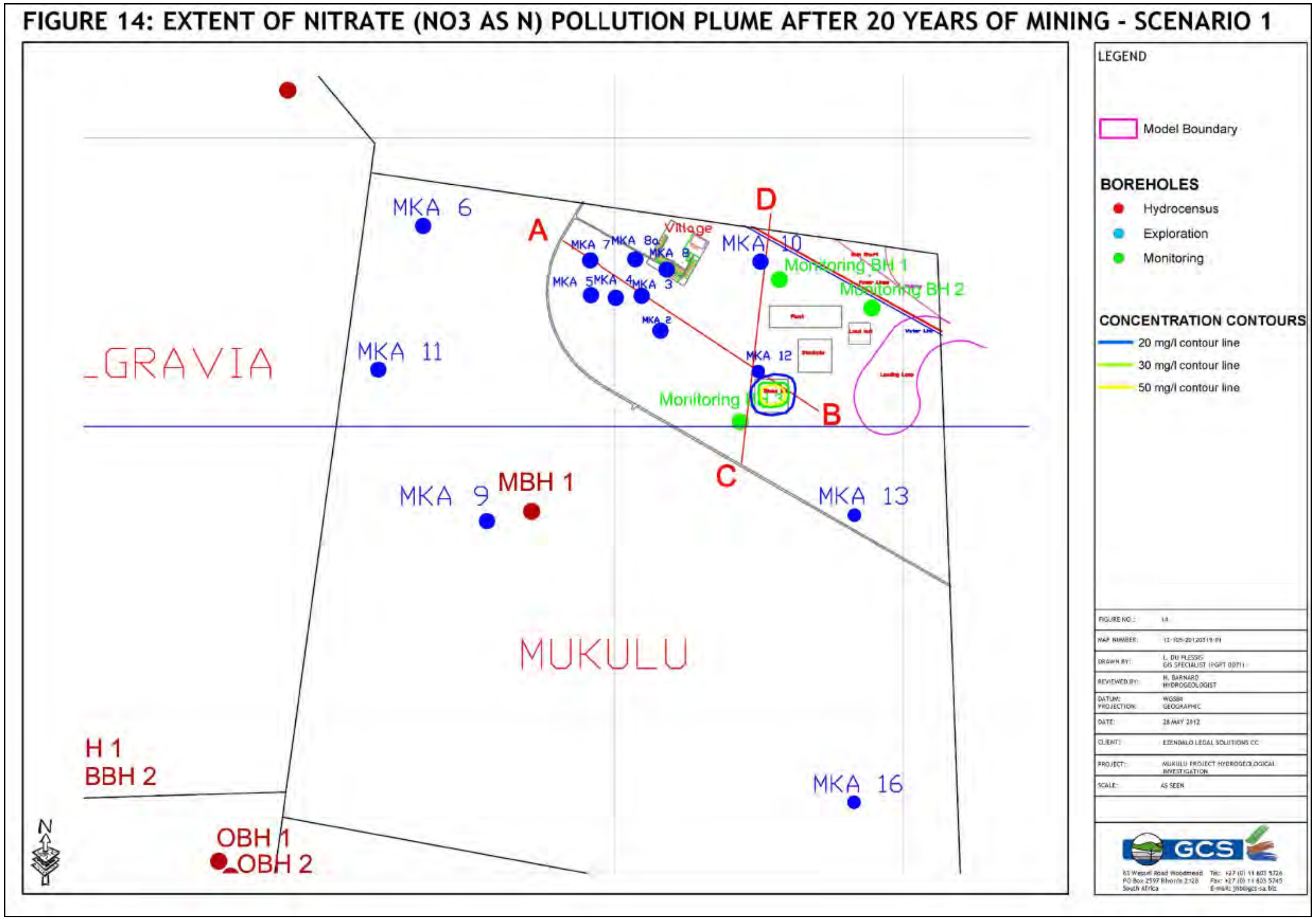


Figure 7.2 Nitrate pollution plume associated with perched aquifer after 20 years of mining - Scenario 1

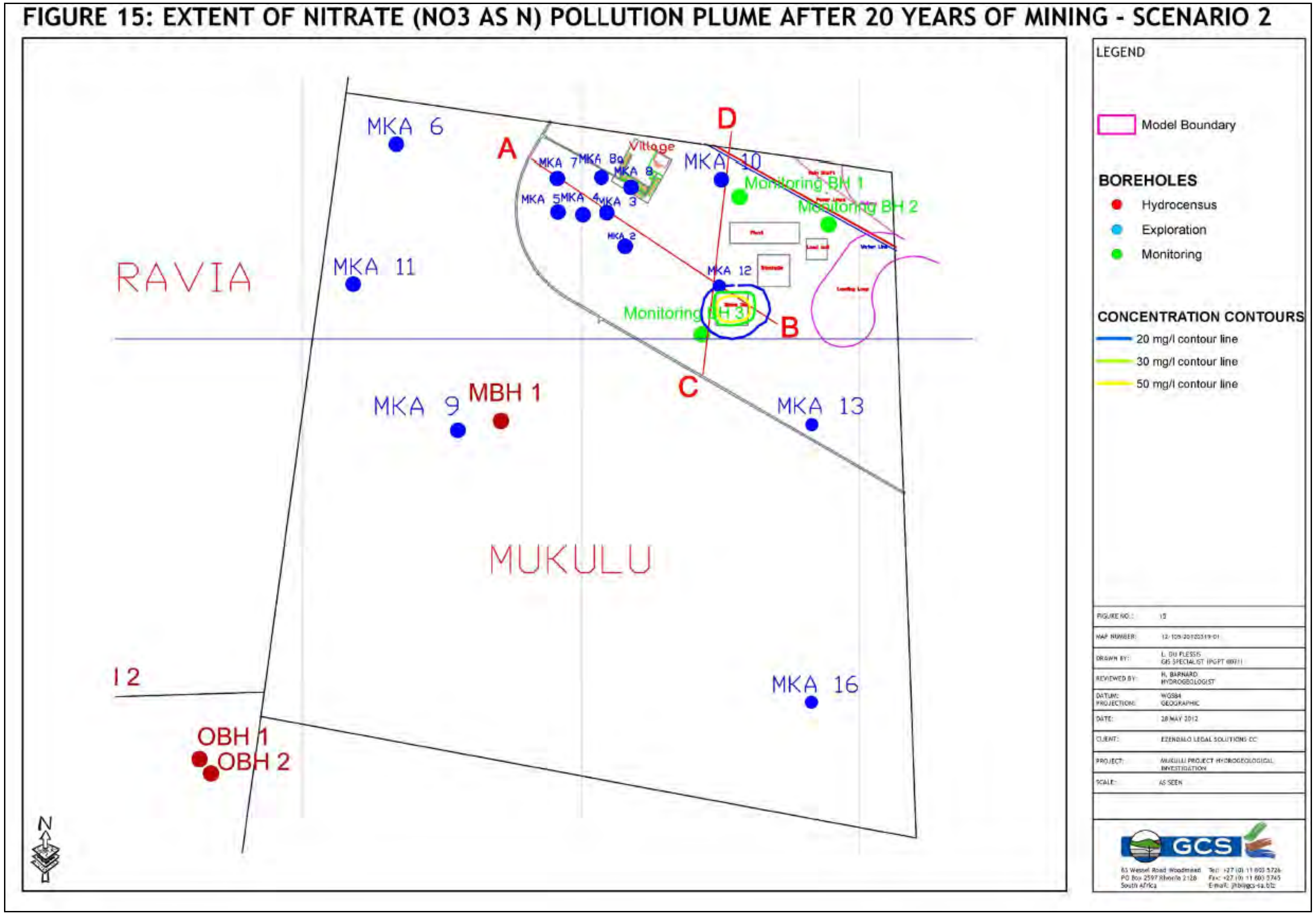


Figure 7.3 Nitrate pollution plume associated with perched aquifer after 20 years of mining - Scenario 2

7.3.4 Surface water

The risks to surface water during the construction phase are considered to be of low significance. The impacts are related to contaminated runoff which can be easily mitigated and managed by maintaining the storm water management structures which will be constructed during the construction phase; handling and storing potential pollutant in compliance with best practices and managing spills according to the EMP immediately after they occur.

There is also the potential for the pond on the farm Belgravia 264 to be polluted once the shaft on this property is phased in. It appears that this pond is used as a source of water by animals on the property. It is recommended that this dam is replaced by another dam and is decommissioned prior to the sinking of the Belgravia shafts.

7.3.5 Wetland and Aquatics

There are no wetlands areas within 1 000m of any proposed surface infrastructure or shafts, therefore no wetlands will be impacted on by the proposed mine operation.

7.3.6 Terrestrial Biodiversity

The impacts on flora and fauna will involve the proliferation of invasive plant species, damage to flora and fauna by fire, as well as harm to fauna by people and cars on access roads.

Ongoing training must be provided to mine employees must be trained to indentify sensitive and Red Data plant species and to follow protocol to prevent the damaging or destroying these plants if still present. The procedures for the management of impacts on animals must also be clearly communicated. This will include the implementing speed limits to prevent the death of animals on roads; prohibiting the capturing, hunting and any other harmful activities to animals; prohibiting domestic pets on the site and educating employees on dealing with dangerous animals, e.g. snakes.

7.3.7 Soil, Land use and Land Capability

The impacts posed by the operational activities are associated with the movement of vehicles over roads, soil erosion due to incorrect storm water management, soil pollution due to inefficient waste handling and spillages, as well as the stripping of soils during the establishment of the shafts on the farms Olivewood 284 and Belgravia 264.

These impacts must be managed by compliance with the EMP. The surface infrastructure must remain within the established footprint and the movement of vehicles and people must be limited to the surface infrastructure footprint and established routes. Waste and hazardous materials must be managed in accordance with the management measures in this EMP. It is recommended that spillkits are made available at various areas of the mine and that staff are trained with respect to managing spillages timeously. Spillages must be confined, contained and remediated.

7.3.8 Noise

The lack of an established settlement in the immediate vicinity of the proposed mine surface infrastructure means that there are few to no sensitive receptors. The creation of noise during the operational phase is therefore not considered significant.

7.3.9 Traffic

The impacts on traffic and roads in the area will be limited to transportation of people and supplies to and from the mine. The mine will utilise rail to transport ore. The impact of traffic and roads during the operational phase of the mine is therefore not considered to be significant. If it is found that the impacts on the surrounding roads are significant, the mine will undertake a traffic impact assessment to determine how to reduce the impacts.

7.3.10 Visual

The proposed mine will have an impact on the aesthetics of the area. This impact, although also cumulative in nature, due to the proximity to the existing Assmang Black Rock Mine, will be of low significance due to the limited number of sensitive receptors in the study area. A visual impact assessment study was therefore not considered necessary.

7.3.11 Air Quality

Dust will be created by the use of haul roads, product stockpiling and the transportation ore via conveyors. The lack of an established settlement in the vicinity of the mine means that this impact will be of low significance.

Furthermore, this impact can be easily mitigated through dust suppression spraying of haul roads areas.

7.3.12 Heritage

Most of the site of heritage and cultural significance which were identified within the Mukulu Mine MRA will not be impacted on during the operational phase of the mine. The potential for impacts on the site within the vicinity of Belgravia (Sites 2 and 6, which are graveyards), (4 and 5, which are historical buildings) have the potential to be impacted due to blasting and the creation of dust when the shaft on the farm Belgravia 264 is developed.

It is recommended that a heritage expert is appointed to compile a management plan to conserve and protect the heritage sites. The heritage plan must be updated if the extent and location of mining activities changes.

Any or possible demolition of the identified buildings should be discussed with the Northern Cape PHRA first.

7.3.13 Socio-economic

7.3.13.1 Increase in Population size (in-migration)

Increase in population size (in-migration) will be due to the settlement of people from other areas seeking employment (temporary workers during construction and permanent employees during the operational phase). The social impacts of in-migration are exacerbated when the newcomers are different from, or perceived as being different, from the current residents. An increase in population size can have a variety of social impacts, which ranges from impacts on individuals or households, to impacts on the community. These impacts, depending on the level of in-migration, can for example include:

- Impacts on individuals or households: Reduced level of health; reduced mental health; increased stress, anxiety, alienation, apathy, depression; uncertainty about impact, development opportunities, about own life as a result of social change; reduced actual person safety due to increased hazard exposure; and reduction in perceived quality of life (subjective well being);
- Impacts on community level: Reduced adequacy of infrastructure (water supply, sewerage, services and utilities); reduced adequacy of community social infrastructure, health, welfare and education facilities; reduced adequacy of housing; and increased workload on institutions.
- Surrounding towns, i.e. Kuruman and Kathu, are likely to experience the brunt of the influx of job seekers. This could potentially lead to conflict in terms of access to municipal in social infrastructure and services, including, most critically, housing.

Due to the site's proximity to other existing mines, it is expected that residents within towns surrounding the site will most likely form part of the workforce. It is advised that employment criteria, for all required staff, be made public in advance to deter unqualified job seekers from moving into the area, or other low income areas. It is furthermore advised, that as far as possible, local labour be employed at each phase of the project, especially during the operational phase. Measures should be implemented to verify that job applicants are from local areas. This may require the assistance of appointed community representatives, ward councilors, Community Liaison Officers, etc.

An influx of construction crew during the construction phase, and permanent staff (i.e. administration staff, security, etc) will place an increased burden on the available infrastructure in the towns of Hotazel, Kuruman and Kathu.

7.3.13.2 Effect of temporary workers on social dynamics

The potential in-migration of workers is likely to result in impacts such as conflict with existing community members, social inconveniences and / or problems and pressures on existing infrastructure. The potential in-migration is anticipated to have an effect on the nearby towns of Blackrock and Hotazel)

These impacts are expected to occur during the construction and operation phase. It is advised that, as far as possible, construction workers are housed in towns such as Kuruman and Kathu. The ability of Kuruman and Kathu to accommodate the additional workforce should be addressed in liaison with the local municipality governing those towns.

7.3.13.3 Waged labour

According to the Social and Labour Plan (SLP) for the proposed Mukulu Mine, a total of 507 jobs will be created during the operational phase of the mine. This will comprise 33 professionals, 149 skilled people and 325 semi-skilled people.

It could also be possible that instead of creating new employment, for employees from existing mines to the move to the proposed new mine. A proper recruitment strategy should therefore be drafted that will ensure that the maximum amount of employment opportunities are made available for unemployed persons within the local communities. This strategy should also attempt at reducing the influx of a foreign labour force (sourced from outside the Northern Cape Province), whilst still ensuring that the most appropriately skilled person is employed to guarantee an effective construction and operation process.

In order to ensure that local labour is used as far as possible, Main Street, in association with the local municipality, could conduct a skills audit in order to capture all project relevant skills in the project area. Coupled with this, a recruitment manual could also be used, which should include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on procedures to be followed by aspiring employment seekers and employers. It is also advisable to implement a training strategy for the region. This will assist Main Street to identify and maximise on appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force during the pre-construction phase, during the construction phase and after project implementation. It is recommended that training and skills development activities start during the pre-construction period.

7.3.13.4 Conversion and diversification of economic activities

Conversion and diversification of land use refers to the change in the way land is used, both in terms of the area of land appropriated for a particular activity, the intensity of the use of the land and whether there are areas of land not used for production, and in terms of the type of land use activities and the pattern or mix of those activities.

The land use patterns of the surrounding area comprise of farming (cattle grazing) and mining with intermittent residential use. The current surrounding land use, and on site is agricultural (cattle grazing). The land use patterns, other than the farm Mukulu, are unlikely to be impacted on and changed by the proposed new mine. In most instances, these activities can continue.

However, once the proposed shaft on the farm Olivewood 284 is developed, the land use on this farm may be permanently altered. It is suggested that an updated Social Impact Assessment be conducted at the point in time when this shaft becomes viable. The possible relocation of the landowner, the effect it will have on surrounding landowners, etc will have to be investigated and mitigated.

7.3.13.5 Employment creation and decreased unemployment

Employment opportunities created during operation will be long term (29 year LoM). Increased employment will result in increased expenditure, which will mean economic benefits in other sectors of the economy.

This impact is described in detail under Section 7.2.9.5 of this report.

7.3.13.6 Transportation (traffic) and accessibility

This impact is expected to be negligible during the operational phase, as Main Street intends to transport the ore via rail.

7.3.13.7 Capacity building and skills transfer

It is anticipated that there will be a transfer of skills during the operational phase. The most dominant occupation type directly created by the proposed mine is that of general worker and learner miner with secondary functions such as services (financial and human resource management, kitchen staff, cleaning staff, security, etc.). The operational phase will provide long-term employment opportunities that will be sustainable in nature.

It is further expected that the proposed mine will create employment opportunities that will result into the transfer of skills. Skills development is necessary for human resource development, and will have a lasting impact on the economy. Skills development will also form a large part of Main Street's SLP responsibilities, which will be audited on an annual basis.

According to Regulation 46 of the MPRDA Regulations, R527, an SLP must include a Human Resource Development Programme (HRDP), which should include, a Career Development and Progression Plan; a Skills Development Plan; a Mentorship and Coaching Plan; an Internship / Bursary Plan; and Employment Equity Plan.

The primary objective of the HRDP is to ensure the availability of mining and production operation specific skills and competencies of the workforce, and the development of portable skills, which can be used by the employees outside their working life in the mining industry.

The aim of the Skills Development Plan is to provide quality training interventions to employees designed to increase the competency levels, recognise prior learning and facilitate career progression.

7.3.13.8 Deviant social behaviour

This impact can be defined as types of social behaviour that might be considered deviant or antisocial, such as excessive alcohol consumption, illegal drug use, various types of risk-taking behaviours and vandalism. It is expected that this impact will, to varying degrees, occur during the construction and operational phases of the new mine. There is a risk that the presence of “incoming” workers and or the influx of jobseekers can lead to deviant social behaviour in the communities they occupy.

During the construction and operation phase it is possible that petty crime in the area could increase as a result of the influx of strangers into the area. It is strongly recommended that the South African Police Services (SAPS), in association with existing Community Based Organisations and NGO’s be used to monitor and assist with the management of the negative social effects of incoming job seekers and strangers. These organisations will ensure that conditions stipulated by the EMP be fully complied with.

7.3.13.9 Actual Health and Fertility

Once the mine is in full operation, it is expected that the existing health services within Kuruman, Kathu and Hotazel would come under additional strain. The Joe Morolong LM, especially, should ensure that sufficient health infrastructure be provided to cope with the increased demand. However, Main Street will also have to ensure that their employees have free access to clinic services, counselling and treatment.

The prevalence of HIV/Aids among the mine employees, and the potential spread of the virus to the surrounding community could have a negative effect on the local community as should be closely managed.

7.3.13.10Feelings in relation to the project

This impact is discussed in detail under Section 7.2.9.12.

7.3.13.11Physical quality of the living environment (actual and perceived)

Proposed projects and developments often generate uncertainty, anxiety or fear and sometimes, the impacts perceived in anticipation of the planned intervention can be greater than the impacts that ultimately result from the intervention (Burge and Vanclay, 1995). These impacts include uncertainty, annoyance, dissatisfaction due to a failure of the project to deliver promised benefits and an experience of moral outrage, for example where a project leads to violation of deeply held moral or religious beliefs or requires households to relocate their houses to make way for the new project.

Although the feelings of residents may be biased sometimes, they should not be disregarded. In order to develop the mine in a responsible manner, Main Street should take cognizance of biophysical and social impacts. Social impacts are often subjective and there is a need to address both actual and perceived impacts.

It is therefore suggested that a detailed and transparent PPP be followed in order to address any feelings of mistrust. Furthermore, all I&APs should be kept informed on the progress of the mining right application and all potential benefits (or impacts) that may derive, should the mining right be approved.

7.3.13.12 Aesthetic quality of the living environment

The visual impact of a mining development is influenced by the terrain, relief of surrounding areas as well as by the population density, transport routes or other development nodes, which will all impact on its visual absorption capacity. Mine's may also be able to impact on the "Sense of Place", that quality that makes the place unique or distinct with a character of its own. Visual quality or aesthetic appeal might also be affected if the degree of visual diversity or complexity, discernible textures or patterns or striking features and the landscape character are impacted.

A new mining development with its above ground infrastructure (shaft, rock dump, etc), together with the other existing mines in the surrounding area could have an impact on the adjacent farmers. However, since the main infrastructure will be directly opposite the existing Black Rock Mine, the visual impact, although it is cumulative in nature, will be of a lesser extent.

7.3.13.13 Availability and quality of housing

It is advised that housing allowances and transportation are provided are paid rather that constructing hostels permanent employees.

The assertion that permanent employees will be housed in either Kathu or Kuruman should be investigated. Housing within these towns is already under serious strain with limited infrastructure available to existing residents. Main Street should present their housing proposal to the applicable local municipalities and come to an agreement before the mining commences.

7.3.13.14 Adequacy of physical infrastructure / increased pressure on existing infrastructure

A transport service for transporting workers to and from their places of residence will have to be provided, which will result in large vehicles and an increase in traffic to and from the mining site. Main Street, in liaison with the local roads and traffic department should seek ways of addressing this impact.

7.3.13.15 Adequacy and access to social infrastructure

As a result of the proposed new mine, the new residents and their associated activities will require a variety of services provided by the public and private institutions. The goods and services include cultural and recreation facilities; education; health care; special care for the elderly, the disabled, the indigent and pre-school-age children; police and fire protection; and a variety of administrative support functions.

Service resources are objective indicators of the level of resources available for the satisfaction of society's needs, e.g. the number of physicians, dentists, acute-care hospital beds, and psychiatric care hospital beds are indicators of the level of health care resources. Square meters of parks, picnic areas, children play areas, etc., are indicators of facilities for recreation needs.

In terms of the MPRDA, the applicant for a mining right must, through the means of its SLP, ensure that it fulfills its responsibilities (i.e. provision of physical and social infrastructure) to the communities in which they will operate, as well as the communities from where they will source their labour. The SLP requirements furthermore state that these projects should be decided on, in consultation with the LM and in cognisance of their approved IDP document. LED projects should confirm to certain criteria, which include:

- Promote employment and advance the socio-economic welfare of all South Africans;
- Contribute towards the transformation of the mining industry;
- Contribute towards the sustainable socio-economic development of the area of operation; and
- Ensure job creation and income generation opportunities.

It is anticipated that the proposed mine would result in social development and social services support through local economic development. Care should, however, be taken to communicate LED commitments and timeframes in a clear and unambiguous manner and to implement these projects as soon as possible. Failure to implement projects could lead to a situation whereby the local communities are disillusioned by Main Streets' commitments.

7.3.13.16 Personal safety and hazard exposure

During the operational phase, a variety of potential risks, usually associated with mining are expected. Horizontal and vertical transportation of people and materials is regarded as a risk area in mining and an integrated, long-term strategy should be put in place to manage this impact. The regular monitoring of equipment should be undertaken and transport safety principles should be introduced.

During the mine operations, workers may also be exposed to hazards such as rock falls. This may be related to either seismic activity or gravity. The following measures should be put in place:

- Prevent excess rock damage ahead of the work face (mine design);
- Protect workers from rock falls in the workplace (mine support standards);
- Promote safe behaviour and work practices;
- Provide warning signals of undesired trends (seismic and other monitoring); and
- Introduce problem solving through research and development of new technology.

Hazard exposure not only relates to physical mining activities, but also the storage of hazardous substances (diesel and explosives) on site. Even though there are strict measures to which Main Street will have to comply in terms of the storage, transportation and handling of these substances, this remains a potential hazard that needs to be addressed.

7.3.13.17 Crime and violence

The influx of potential job seekers, as well as the increase in movement and activity as a result of mining activities in areas in close proximity to the mining activities is likely to result in an increase of petty criminal activities.

It is also anticipated that the influx of newcomers will lead to the increase of actual crime and violence in the local communities. There is often fierce competition for job opportunities, and should newcomers to the area be employed, rather than local community members, this could result in resentment and even violence.

7.3.13.18 Loss of natural and cultural heritage

Protection of archaeological sites and cultural heritage is an important factor in mine planning, both in the context of greenfield and brownfield developments. Whereas previously undeveloped sites require archaeological investigations of areas to be disturbed many of the old mines preserve buildings or other cultural sites that are either protected or worthy of conservation. A cultural resource management investigation is a necessary part of any mine development and closure plan to ensure that the developer is aware of the range of cultural issues that could constrain the development or post-closure land-use options.

In this regard, the recommendations of the Heritage Impact Assessment, conducted as part of the EIA should be implemented.

7.3.13.19Functioning of government agencies

During the operational phase various local government departments will be involved in decision-making processes and stakeholder buy-in support, such as the:

- Joe Morolong LM / LED Offices;
- Department of Education;
- Department of Agriculture;
- Department of Roads, Transport and Public Works; and
- Department of Mineral Resources.

The LMs input would be required to identify and implement feasible community and social development projects and ensure compliance to the regulations and EMP.

7.3.13.20Impact equity

Impact equity refers to fairness of the distribution of impacts (positive and negative) across the community. People who will benefit from the development must also share in carrying the costs. The project will lead to gain on a regional level, whereas the local communities such as the local farming community will not necessarily benefit in terms of financial benefits and employment opportunities.

It is therefore important to recognise that infrastructure developments such as this mine must be sustainable and recognise people as an element of the environment. The implementation of the SLP will therefore play a major role in ensuring that impact equity take place. The implementation of the SLP must further ensure that adequate social planning and infrastructure development take place and ensure that it can be maintained by the communities after mine closure.

7.3.13.21Gendered division of labour

In most societies certain roles, occupations, responsibilities and qualities are associated with being male or female (i.e. gendered division of labour). While some of these roles have biological origins, many are socially constructed and deeply entrenched by history and tradition. Traditionally, women are represented in the caring professions (i.e. healthcare, education, etc) and lacks representation in high paying professions, such as engineering (mining, construction and manufacturing).

Women still face barriers to entering and participation in the mining sector, even though South African legislation compels mining companies to employ women at all levels. The lack of participation has been attributed to low levels of education (specifically technical training), companies with unsupportive work cultures, a lack of mentors for women in the workplace and the lack of facilities and attention to ergonomics for women in mining (AngloGold Ashanti, Report to Investors, 2005).

A greater understanding of the barriers women face in the mining sector could improve women’s opportunities in the sector, and assist in achieving the targets set out in legislation (i.e. 10% of women in mining).

In the context of sustainable development, gender equity is based on grounds of human rights and since 1994 a number of laws have been passed that is concerned with social transformation. Amongst these laws are the Employment Equity Act, 1998 (Act No 55 of 1998), the Preferential Procurement Framework Act (Act No 5 of 2000), the Broad Based Black Economic Empowerment Act, 2003 (Act No 53 of 2003) and the MRPDA, supported by the BBSEEC, which expands on the social provisions of the MRPDA.

7.3.14 Cumulative Impacts

7.3.14.1 Geology

The available geology resources of the area will be reduced due to the additional underground mining operation. Although this impact is expected to be of medium significance, no mitigation is possible as mining permanently impacts on the geological strata. The mining activities will, however, remain within the MRA. It should also be noted that the geological resources are owned by the state and the objective of the applicant is to optimally mine these resources should the mining right be awarded.

7.3.14.2 Groundwater

The drawdown of groundwater levels must be seen as a cumulative impact, where neighbouring mining activities are also busy with underground dewatering and the consequent dewatering of the deeper aquifers.

Therefore it is recommended that a regional groundwater investigation, including all mines in the area, be undertaken to understand/calculate the full cumulative impact of mine dewatering on the regional groundwater level. This should be an initiative driven by the DWA, but should start with an environmental committed to be established between the mines, surrounding landowners, municipality and the DWA.

7.3.15 Operational Phase Impact Assessment and Management Programme

The impacts which are anticipated during the operational phase were assessed and the results of this assessment are presented in the tables which follow. Each table also includes the required action plan, frequency of the management measures, the associated costs per annum, as well as the person responsible for undertaking the required actions.

The construction phase impacts on the biophysical and heritage environment are described under sections 7.3.13.1 to 7.3.13.9.

Socio-economic impacts can be contributed to the overall mining operation and not just any particular construction activity to particular physical construction operational activities; therefore the socio-economic impacts associated with the construction operational phase are presented under Section 7.3.13.10.

7.3.15.1 Mining (underground)

The potential impacts on the biophysical environment associated with the proposed underground mining activities (mining underground, dewatering underground works, etc.) is presented in Table 7.8.

Table 7.8 Mukulu Mine Impact Assessment and Management Plan: Operational Phase -Mining

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TO	SP		M	D	S	P	TOT	SP				
Operational Phase: Mining (underground)																		
Issues related to TOPOGRAPHY																		
Risk of subsidence	Underground mining	10	5	1	5	80	H	• The risk of subsidence has not been established. It is recommended that a Geotechnical Investigation is commissioned prior to the establishment of infrastructure on Mukulu 265 to determine if the risk exists. • The mine will ensure to establish measures to stabilized the underground mining operations to reduce subsidence.	4	2	1	1	7	L	Appoint specialist to undertake Geotechnical Investigation	Prior to construction	Project Manager	Will be determined once a tender is approved for the study
Issues related to GEOLOGY																		
Altered geology	Removal of underground material during mine access establishment	4	5	1	5	50	M	No mitigation measures are possible, as mining permanently destroys the geological strata. The mining operations will remain within the limits of the designated mining rights area.	4	5	1	5	50	M	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Soil compaction	Underground mining	2	4	6	4	48	M	Keep infrastructure localized to reduce footprint.	2	4	4	4	40	M	N/A	N/A	N/A	N/A
Soil erosion	Underground mining	1	5	8	4	56	M	Keep as much original land cover as possible	1	3	4	4	32	M	Monitor rehabilitated areas after construction	Monthly	Environmental Officer	Included in operating costs
Issues related to WETLANDS																		
As no surface subsidence will occur, no impact will occur to any of the pans on site.	Underground mining	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
None	Underground mining	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FLORA																		
None	Underground mining	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																		
None	Underground mining	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

Issues related to SURFACE WATER																		
None	Underground mining	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GROUNDWATER																		
Groundwater will be intersected in underground operations. Dewatering will take place to ensure a safe working environment.	Mine dewatering	6	5	2	5	65	H	• All dewatered water must be stored for re-use at the mine; • Groundwater monitoring programme must be implemented immediately and groundwater model must be up dated as soon as new information become available. • Predicative modelling will help to determine if any groundwater users will be negative impacted. • An open channel of communication will be established to ensure that surrounding farmers have the opportunity to raise any potential concerns. • Should and impact be determine on the groundwater, an independent groundwater specialist will be appointed to assess the cause and extent of the impact. Should the impact be mine related the mine will enter into negotiations with the landowner, together with the DWA to determine a way forward.	6	5	2	5	65	H	Implement groundwater monitoring	Monthly	Environmental Officer and Groundwater specialist	R160 000
Issues related to HERITAGE AND ARCHAEOLOGY																		
Heritage - Graves - sites 2, 3, 6	Blasting and dust	10	4	2	5	80	H	Implement Heritage Management Plan	6	4	2	2	24	L	Appoint heritage expert to compile heritage management plan	Prior to construction	Project Manager	R40 000 - once off
Heritage - Buildings - sites 1, 4, 5, 7, 8, 11	Blasting and dust	10	4	2	5	80	H	• Implement Heritage Management Plan for site 1. • Monitor the remaining sites.	6	4	2	2	24	L	Appoint heritage expert to compile heritage management plan	Prior to construction	Project Manager	R40 000 - once off
															Monitor sites within a 1km radius of the blasting sites	After blasting takes place	Environmental Officer	Included in operating costs
Issues related to NOISE												•						
None	Underground mining	0	0	0	0	0	L	• Undertake blasting during the day; • Inform landowners and tenants within and around mining area before blasting takes place.	0	0	0	0	0	L	Establish landowner forum/environmental committee to communicate with I&APs	Prior to construction	Community liaison officer	Included in construction costs
Issues related to TRAFFIC																		
None	Underground mining	0	0	0	0	0	L	No impacts are foreseen as ore will be transported via rail.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
None	Underground mining	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.3.15.2 Product Stockpiling

The potential impacts on the biophysical environment associated with the required product stockpiles are presented in Table 7.9.

Table 7.9 Mukulu Mine Impact Assessment and Management Plan: Operational Phase - Product Stockpiling

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Operational Phase: Product Stockpiling																		
Issues related to TOPOGRAPHY																		
Change in natural topography	Vegetation removal and shaping of landscape	4	4	2	3	30	L	• Keep stockpile areas confined to the smallest area possible.	2	4	2	2	16	L	N/A	N/A	N/A	N/A
None	Product Stockpiling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Soil compaction	Product Stockpiling	2	4	6	4	48	M	• There are no further additional management measures that can be implemented as most impacts on the soils would be mitigated during the construction phase. • Keep infrastructure localized to reduce footprint	2	4	4	4	40	M	N/A	N/A	N/A	N/A
Issues related to WETLANDS																		
No wetlands fall within 1000m of the indicated surface infrastructure areas , thus no impact expected	Product Stockpiling	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
None	Product Stockpiling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FLORA																		
Loss or degradation of natural vegetation due to an increase in the presence of invasive species	Product Stockpiling	6	5	2	4	52	M	• A detailed weed management programme will be established and enforced on the mine; • The monitoring of invasive species will be undertaken on a scheduled timeframe and will be allocated to a specific responsible person	6	5	2	3	39	M	Compile weed/alien plant eradication programme.	During construction	Environmental Coordinator	Included in construction cost
															Implement a weed and alien invasive species eradication programme during the life of the mine all areas. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings.	Monthly	Environmental Officer	R 22 000
Issues related to AIR QUALITY																		
Creation of dust	Product Stockpiling	6	4	2	4	48	M	• Implement dust suppression spaying of stockpile regularly. • Dust monitoring will be undertaken to determine the	4	4	1	2	18	L	Implement air quality monitoring programme	Prior to construction	Environmental Coordinator with air quality specialist	R90 000

							extent of dust dispersion and to achieve baseline conditions prior to the mining operations.							Provide dust suppression equipment and water.	During construction	Contractor	Included in construction cost
Issues related to SURFACE WATER																	
Contamination from dirty runoff	Product Stockpiling	6	2	2	2	20	L	• Storm water Management Plan must be implemented and maintained. • All water falling on or originating from the stockpiles will be considered dirty water.	2	1	2	1	5	L	Undertake maintenance of storm water management measures and dirty water dams Undertake monitoring of dirty water dams	Regularly during operational phase Monthly	Environmental Officer Surface water specialist	Included in operating costs R80 000
Issues related to GROUNDWATER																	
Ore will be stockpiled at the stockpile and load out areas. It was argued that the potential for acid mine drainage is low and leaching test shows that no element will become mobile under normal natural pH and EH conditions. However, elements that could potentially impact on the groundwater quality include nitrates from blasting (up to 150 mg/L). Seepage with elevated concentrations of nitrate from the dumps can enter the groundwater environment and migrate laterally. Predicted impacts based on the contaminant transport modelling shows that the extent of influence of the plume can be up to 250m away from these areas.	Spreading of contaminant plume	6	4	2	3	36	M	• The stockpile and load out area (where stockpiling will take place) should be lined; • Boreholes will be placed in positions to determine the upstream and downstream water quality of all dirty water systems; • Water monitoring will be undertaken according to the groundwater monitoring programme of the EMP or as required by the DWA	2	4	1	1	7	L	Implement groundwater monitoring programme	Monthly	Environmental coordinator and groundwater specialist	R 160 000
Issues related to HERITAGE AND ARCHAEOLOGY																	
None	Product Stockpiling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																	
None	Product Stockpiling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																	
None	Product Stockpiling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																	
Poor visibility due to dust creation	Product Stockpiling	4	3	2	4	36	M	Implement dust suppression spraying where necessary.	2	3	2	2	14	L	Provide dust suppression equipment and water.	During operation	Environmental Officer	Included in operating costs
Change to aesthetics of the landscape	Product Stockpiling	4	4	2	4	40	M	• Keep stockpile areas confined to the smallest area possible; • Use of visual screening where necessary, e.g. planting of trees.	4	3	2	2	18	L	Discuss visual impacts with the landowner forum/environmental committee to determine the impacts	During construction	Environmental Officer	Included in operating costs

7.3.15.3 Conveyor belts- transportation of ore

The potential impacts on the biophysical environment associated with the required transportation or ore via conveyors between the shafts and the ROM stockpile on the farm Mukulu 265 are presented in Table 7.10.

Table 7.10 Mukulu Mine Impact Assessment and Management Plan: Operational Phase – Transportation of ore

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Operational Phase: Conveyor belts- transportation of ore																		
Issues related to TOPOGRAPHY																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Chemical soil pollution	Spillage of diesel along conveyor route	8	2	2	5	60	H	• A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site; • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained; • Determine the depth and width that the oil/diesel has penetrated into the soil as far as possible, by digging up the polluted soil (excavating); and • Remove the polluted ground to one side and mix it thoroughly with the bioremediation powder	4	2	2	4	32	M	Conduct environmental induction for workers	Prior to operational phase	Environmental Officer	Included in construction cost
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in construction costs
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected	Transportation of ore	0	0	0	0	0	L	None Required	0	0	0	0	0	L	N/A			
Issues related to FAUNA																		
Loss or degradation of natural fauna habitat	Spillage of diesel along conveyor route	8	4	2	4	56	M	• A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site; • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained.	8	4	2	3	42	M	Conduct environmental induction for workers	Prior to operational phase	Environmental Officer	Included in operating costs
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in operating costs
Issues related to FLORA																		
Loss or degradation of natural vegetation/ pristine habitat	Spillage of diesel along conveyor route	6	5	2	4	52	M	• A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site;	6	4	2	4	48	M	Conduct environmental induction for workers	Prior to operational phase	Environmental Officer	Included in operating costs
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000

								• Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained; • The spilled substance must be captured and stored in a suitable container within a bunded area; • Determine the depth and width that the oil/diesel has penetrated into the soil as far as possible, by digging up the polluted soil (excavating); and • Remove the polluted ground to one side and mix it thoroughly with the bioremediation powder.							Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in operating costs
Issues related to SURFACE WATER																		
Contamination from dirty runoff	Operations	6	2	2	2	20	L	• Storm water Management Plan implemented and maintained; • All spills must be collected immediately.	2	1	2	1	5	L	Undertake maintenance of storm water management measures and dirty water dams	Regularly during operational phase	Environmental Officer	Included in operating costs
Issues related to GROUNDWATER																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.3.15.4 Beneficiation Plant

The potential impacts on the biophysical environment associated with the operation of the beneficiation plant on the farm Mukulu 265 are presented in Table 7.11.

Table 7.11 Mukulu Mine Impact Assessment and Management Plan: Operational Phase - Beneficiation Plant

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Operational Phase: Beneficiation Plant																		
Issues related to TOPOGRAPHY																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
None	Transportation of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site. • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained. • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.	1	3	4	4	32	M	Conduct environmental induction for workers	Prior to operational phase	Environmental Officer	Included in operating costs
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in construction costs
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected	Processing of ore	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
No significant impacts envisaged	Processing of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

Issues related to FLORA																			
Loss/ degradation of surrounding habitat	Processing of ore	6	4	2	3	36	M	• A detailed weed management programme will be established and enforced on the mine; • The monitoring of invasive species will be undertaken on a scheduled timeframe and will be allocated to a specific responsible person	4	4	2	3	30	L	Compile weed/alien plant eradication programme.	During construction	Environmental Coordinator	Included in operating costs
															Implement a weed and alien invasive species eradication programme during the life of the mine all areas. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings.	Monthly	Environmental Coordinator	R 22 000
Issues related to AIR QUALITY																			
No significant impacts envisaged	Processing of ore	0	0	0	0	0	L	None required	0	0	0	0	0	L				
Issues related to SURFACE WATER																			
Contamination from dirty runoff	Operations	6	2	2	2	20	L	• Storm water Management Plan must be implemented and maintained. • All water falling on or originating from the stockpiles will be considered dirty water.	2	1	2	1	5	L	Undertake maintenance of storm water management measures and dirty water dams	Regularly during operational phase	Environmental Officer	Included in operating costs
															Undertake monitoring of dirty water dams	Monthly	Surface water specialist	R80 000
Issues related to GROUNDWATER																			
Contamination of underlying aquifers	Accidental Spillages	4	2	1	2	14	L	• Normal in-house management and best practices by mine management to ensure that all systems are working properly and prevent accidental spillages; • PCD will be effectively designed and managed; • All water originating or falling within the plant area will be regarded as dirty; • The groundwater resources will be monitored as required in the EMP or as required by the DWA; • Should impacts on groundwater be encountered an independent groundwater specialist will be appointed to investigate the source and extent of pollution; • Should the mine be responsible the mine, together with the surrounding landowners and the DWA will formulate an agreement	2	2	1	2	10	L	Undertake maintenance of storm water management measures and dirty water dams	Regularly during operational phase	Environmental Officer	Included in operating costs
															Undertake monitoring of dirty water dams	Monthly	Surface water specialist	R80 000
															Implement groundwater monitoring programme	Monthly	Environmental coordinator and groundwater specialist	R 160 000
Issues related to HERITAGE AND ARCHAEOLOGY																			
None	Operation of Beneficiation Plant	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																			
None	Operation of Beneficiation Plant	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

Issues related to TRAFFIC																		
None	Operation of Beneficiation Plant	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
None	Operation of Beneficiation Plant	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.3.15.5 Paste Disposal Facility

The potential impacts on the biophysical environment associated with the operation of the Paste Disposal Facility on the farm Mukulu 265 are presented in Table 7.12.

Table 7.12 Mukulu Mine Impact Assessment and Management Plan: Operational Phase - Paste Disposal Facility

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Operational Phase: Paste Disposal Facility																		
Issues related to TOPOGRAPHY																		
Change to natural landscape	Operation of PDF	6	5	2	3	39	M	The PDF will be built with a view to closure. All dumps will be shaped during the operation phase to look as natural as possible. Minimal shaping of dumps is envisaged during the rehabilitation period.	4	5	2	2	22	L	Mine design to incorporate shaping of dumps	Planning Phase	Mine Engineer	Included in planning costs
Issues related to GEOLOGY																		
None	Operation of PDF	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Soil Pollution	Operation of PDF	6	4	2	3	36	M	• The paste disposal facility will be lined with a liner as agreed to with the DWA; • All water originating from or falling on the paste disposal facility will e considered dirty water and will be contained in PCDs and RWD in order to avoid the contamination of the surrounding soils and land capability	4	4	2	2	20	L	Undertake maintenance of storm water management measures and dirty water dams	Regularly during operational phase	Environmental Officer	Included in operating costs
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected	Operation of PDF	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
Harm to animals	Drinking from dirty water dams	8	4	3	4	60	H	The PCDs and RWD associated with the plant and paste disposal facility will be covered with a mesh or some suitable product to deter animals or birds form the area.	4	4	2	2	20	L	Undertake monitoring of dirty water dams	Monthly	Surface water specialist	R80 000
Issues related to FLORA																		
Loss/ degradation of surrounding habitat	Proliferation of invasive plant species	6	4	2	3	36	M	• A detailed weed management programme will be established and enforced on the mine; • The monitoring of invasive species will be undertaken on a scheduled timeframe and will be allocated to a specific responsible person	4	4	2	3	30	L	Compile weed/alien plant eradication programme.	During operation	Environmental Officer	Included in operating costs
															Implement a weed and alien invasive species eradication programme during the life of the mine all areas. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings.	Monthly	Environmental Officer	R 22 000

Issues related to NOISE																		
None	Operation of PDF	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Operation of PDF	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
Change to aesthetics of the area	Operation of PDF	2	5	2	3	27	L	The PDF will be built with a view to closure. All dumps will be shaped during the operation phase to look as natural as possible. Minimal shaping of dumps is envisaged during the rehabilitation period.	2	5	2	2	18	L	Mine design to incorporate shaping of dumps	Planning Phase	Mine Engineer	Included in planning costs

7.3.15.6 Clean and Dirty Water systems

The potential impacts on the biophysical environment associated with the implementation of surface water management measures, i.e. the diversion of clean water away from dirty areas and the containment of all dirty water on the farm Mukulu 265 are presented in Table 7.13.

Table 7.13 Mukulu Mine Impact Assessment and Management Plan: Operational Phase – Clean and Dirty Water Systems (PCDs and RWD)

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S					M	D	S	P	TOT	SP				
Operational Phase: Clean and Dirty Water systems																		
Issues related to TOPOGRAPHY																		
None	Clean and dirty water separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
None	Clean and dirty water separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	H	• Storm water Management Plan implemented and maintained; • All spills must be collected immediately; • All runoff from dirty areas will be contained within the PCD and RWD.	1	3	4	4	32	M	Undertake maintenance of storm water management measures and dirty water dams	Regularly during operational phase	Environmental Officer	Included in operating costs
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Environmental Officer
															Undertake monitoring of dirty water dams	Monthly	Surface water specialist	R80 000
Issues related to WETLANDS																		
No wetlands fall within 1000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected. A zero discharge policy will be maintained.	Clean and dirty water separation	0	0	0	0	0	L	Zero discharge of polluted water should be allowed.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
Harm to animals	Drinking from dirty water dams	8	4	3	4	60	H	The PCDs and RWD associated with the plant and paste disposal facility will be covered with a mesh or some suitable product to deter animals or birds form the area.	4	4	2	2	20	L	Undertake monitoring of dirty water dams	Monthly	Surface water specialist	R80 000
Issues related to FLORA																		
None	Clean and dirty water separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																		
None	Clean and dirty water separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

Issues related to SURFACE WATER																	
Contamination from dirty runoff	Inadequate capacity of dams	2	2	2	2	12	L	• Storm water Management Plan implemented and maintained; • The PCDs and RWD must be maintained regularly by the removal of silt; • Removal of plant growth in or around dirty water system.	2	1	2	1	5	L	Undertake maintenance of storm water management measures and dirty water dams	Regularly during operational phase	Environmental Officer	Included in operating costs
															Undertake monitoring of dirty water dams	Monthly	Surface water specialist	R80 000
Issues related to GROUNDWATER																	
Contamination of underlying aquifers	Accidental Spillages	4	2	1	2	14	L	• Normal in-house management and best practices by mine management to ensure that all systems are working properly and prevent accidental spillages. • All dirty water containment structure (dams, trenches) must be lined with a liner as agreed to by the DWA.	2	1	1	2	8	L	Undertake maintenance of storm water management measures and dirty water dams	Regularly during operational phase	Environmental Officer	Included in operating costs
Issues related to HERITAGE AND ARCHAEOLOGY																	
None	Clean and dirty Water Separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																	
None	Clean and dirty water separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																	
None	Clean and dirty water separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																	
None	Clean and dirty water separation	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.3.15.7 Generation and handling of waste

The potential impacts on the biophysical environment associated with the generation and handling of waste at the mine are presented in Table 7.14.

Table 7.14 Mukulu Mine Impact Assessment and Management Plan: Operational Phase - Generation and Handling of waste

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S					M	D	S	P	TOT	SP				
Operational Phase: Generation and handling of waste																		
Issues related to TOPOGRAPHY																		
None	Generation and handling of waste	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
None	Generation and handling of waste	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	H	• Solid waste must be stored at site on an approved waste disposal area, or removed by credible contractors; • An intercept drain should be constructed upslope of the construction and operational areas, in order to re-direct clean water away from the area to avoid soil chemical pollution to clean groundwater resources; and • An intercept drain should possibly be constructed downslope of the construction and operational areas, in order to drain potentially polluted water into a pollution control dam.	1	3	4	4	32	M	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in operating cost
															Provide spillkits at all area on site	During construction	Contractor	Spillkit- R22 000
Chemical soil pollution	Spillage of used hydrocarbons or chemicals	8	2	2	5	60	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals	4	2	2	4	32	M	Conduct environmental induction for workers	Prior to construction	Contractor/Project Manager	Included in operating cost
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000

								stored on site. • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained. • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.							Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in construction costs
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected. The distance between the surface disturbances and the wetlands will provide for a sufficient buffer between any pollutants that might enter the environment and the pans on site.	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
Death of fauna	Poor management of domestic waste which may attract scavengers	8	4	2	5	70	H	• A clearly defined waste management system will be put in place; • Waste disposal areas will be placed strategically and easily accessible on site; • Waste recycling will be enforced on site; • Heavy penalties must be enforced for littering on site.	4	4	2	2	20	L	Develop Environmental Management System for construction phase	Prior to construction	Environmental Officer	Included in planning costs
															Conduct environmental induction for workers	Prior to construction	Environmental Officer	Included in operating cost
Issues related to FLORA									•									
Direct impacts on flora species	Spillage of used hydrocarbons or chemicals	8	4	2	5	70	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site. • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained. • All fluids must be contained within properly constructed enclosure with concrete	4	4	2	2	20	L	Conduct environmental induction for workers	Prior to construction	Environmental Officer	Included in operating cost
															Provide spillkits at all area on site	During construction	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage

								flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.							Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Control Officer	Included in construction costs
Issues related to AIR QUALITY																		
None	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SURFACE WATER																		
Contamination from dirty runoff	Waste handling	2	2	2	2	12	L	• Storm water Management Plan must be implemented before construction. • All activities should remain in the dirty water areas of the mine.	2	1	2	1	5	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to GROUNDWATER																		
Negative impact on groundwater quality from fuel & oil spillage. Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate of the groundwater system.	Waste Handling/Fuel Spillage	4	2	1	3	21	L	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site. • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained. • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.	2	2	1	2	10	L	Conduct environmental induction for workers	Prior to construction	Environmental Officer	Included in operating cost
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Control Officer	Included in construction costs
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
None	Waste handling	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Generation and handling of waste	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		

Negative impact on aesthetic quality of the areas	Incorrect storage and handling of domestic waste	6	4	2	4	48	M	Solid waste must be stored at site on an approved waste disposal area, or removed by credible contractors.	4	4	2	2	20	L	Appoint contractor to remove domestic waste from the site on a weekly basis	Prior to construction	Project Manager	Included in construction cost

7.3.15.8 Hydrocarbon and chemical storage

The potential impacts on the biophysical environment associated with the handling and storage of hydrocarbons are presented in Table 7.15.

Table 7.15 Mukulu Mine Impact Assessment and Management Plan: Operational Phase – Hydrocarbon Storage

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Operational Phase: Hydrocarbon storage																		
Issues related to TOPOGRAPHY																		
None	Hydrocarbon storage	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
None	Hydrocarbon storage	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Chemical soil pollution	Spillage of hydrocarbon or chemical	8	2	2	5	60	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site. • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained. • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.	4	2	2	4	32	M	Conduct environmental induction for workers	Prior to operational phase	Environmental Officer	Included in operating cost
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in construction costs
Issues related to WETLANDS																		
No wetlands fall within 1000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected	Hydrocarbon storage	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
Death of animals	Hydrocarbon storage	8	4	2	5	70	H	• Spills should be cleaned immediately; • Hydrocarbons and chemicals	4	4	2	2	20	L	Conduct environmental induction for workers	Prior to operational phase	Environmental Officer	Included in operating cost
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000

								should be stored in contained areas to restrict access by animals.							Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in operating cost
Issues related to FLORA																		
Direct impacts on flora species	Spillage of used hydrocarbons or chemicals	8	4	2	5	70	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site. • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained. • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.	4	4	2	2	20	L	Conduct environmental induction for workers	Prior to operational phase	Environmental Officer	Included in operating cost
															Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in operating cost
Issues related to AIR QUALITY																		
None	Hydrocarbon storage	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SURFACE WATER																		
Contamination from dirty runoff	Operations	6	2	2	2	20	L	• Storm water Management Plan implemented and maintained including relevant oil traps where Hydrocarbon pollution is possible	2	1	2	1	5	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
															Conduct environmental induction for workers	Prior to construction	Environmental Officer	Included in operating cost
Issues related to GROUNDWATER																		
Negative impact on groundwater quality from fuel & oil spillage	Fuel Spillage	4	2	1	3	21	L	Accidental spillage must be minimised and contained. All fluids must be contained within properly constructed enclosure with concrete flooring. Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained	2	2	1	2	10	L	Provide spillkits at all area on site	During operation	Environmental Officer	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Officer	To be determined based on severity of spillage
															Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Officer	Included in operating cost
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Hydrocarbon storage	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
None	Hydrocarbon storage	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

Issues related to TRAFFIC																		
None	Hydrocarbon storage	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
None	Hydrocarbon storage	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.3.15.9 Cumulative Impacts

The cumulative biophysical impacts associated with the operational phase of the proposed Mukulu Mine are presented in Table 7.16.

Table 7.16 Mukulu Mine Impact Assessment and Management Plan: Operational Phase – Cumulative Impact

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Operational Phase: CUMULATIVE IMPACTS																		
Issues related to TOPOGRAPHY																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	L
Issues related to GEOLOGY																		
Alterered geology	Cumulative Impacts	4	5	1	5	50	M	• No mitigation measures are possible, as mining permanently. destroys the geological strata. • The mining operations will remain within the limits of the designated mining rights area.	4	5	1	5	50	M	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
None	Cumulative Impacts	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to WETLANDS																		
No wetlands fall within 1000m of the indicated surface infrastructure areas and shaft localities, so the project will not contribute to any further wetland loss.		0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FLORA																		
Loss/ degradation of surrounding habitat	Proliferation of invasive plant species	6	4	2	3	36	M	• A detailed weed management programme will be established and enforced on the mine; • The monitoring of invasive species will be undertaken on a scheduled timeframe and will be allocated to a specific responsible person	4	4	2	3	30	L	Compile weed/alien plant eradication programme.	During operation	Environmental Coordinator	Included in operating cost
															Implement a weed and alien invasive species eradication programme during the life of the mine all areas. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings.	Monthly	Environmental Coordinator	R 22 000
Issues related to AIR QUALITY																		
Creation of dust	Creation of dust adding to existing air quality impacts	6	2	2	4	40	M	• Demarcate construction footprint and limit activities to within this footprint as far as	4	2	2	2	16	L	Implement dust suppression spraying.	During operation	Environmental Officer	Included in operational cost

								possible; • Keep the clearance area as small as possible; and • Keep as much original land cover as possible; Implement dust suppression spraying where necessary; • Implement dust suppression spraying.										
Issues related to SURFACE WATER																		
Change to water balance of larger area	Decreased runoff from footprint area	6	2	2	2	20	L	• Storm water Management Plan implemented and maintained as the smallest area possible; • Avoid increasing the size of the dirty water catchment.	2	1	2	1	5	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to GROUNDWATER																		
Deeper aquifers are already dewatered to a certain extent due to existing neighbouring mining activities.	Mine dewatering	8	5	2	5	75	H	No mitigation measurements are recommended.	2	4	2	1	8	2	N/A	N/A	N/A	N/A
Monitoring during the specialist investigations have indicated that BH 2 is contaminated with Nitrates	Spreading of contaminant plume	6	4	2	3	36	M	Underlining of stockpile and load out areas with liners as agreed to by the DWA.	2	4	2	1	8	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the NWA.	Prior to construction	Contractor/Project Manager	Included in construction cost
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
None	Cumulative Impacts	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.3.15.10Socio-economic Impacts

The socio-economic impacts associated with the construction phase of the project and the proposed EMP is presented in Table 7.17.

Table 7.17 Mukulu Mine Impact Assessment and Management Plan: Operational Phase – Socio-economic impacts

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Operational Phase: Social Change Process: Economic processes																		
Increase in population size		8	4	3	4	60	H	• Employment criteria should be communicated to the community in advance (e.g. in newspapers, community forum notice boards, etc); • Local labour should be employed as far as possible; • Accommodation for members of the workforce, other than security personnel, will not be permitted on site;	3	8	4	3	45	M	Verify the details of potential employees in order to ensure that local labour is employed.	During operation	Human Resources Manager	Included in operating costs
Effect of temporary workers on social dynamics		6	3	3	3	36	M	• Employ local labour as far as possible (within a 80 km radius); • Accommodation should be provided at suitable locations in Kuruman, Kathu and surrounds; and • Ensure that employees receive adequate health support from the project team for work-related health problems.	4	3	3	3	30	L	Capture all project relevant skills in the project area with the aim to ensure maximum local employment.	During operation	Human Resources Manager	Included in operating costs
															Use of Recruitment manual.	During operation	Human Resources Manager	Included in operating costs
Waged labour		6	3	3	4	48	M	• Unskilled and unemployed labour should be sourced from the surrounding local communities as far as possible; • Skills development opportunities should be granted to community members and local job seekers, where needed; • Maximise employment opportunities for the local communities and reduce the influx of a foreign labour force whilst ensuring an effective construction and operational phase; • Make use of any existing skills databases and include the local councillors and other representative community structures in the process; • Identify and maximise on	6	3	3	3	36	M	Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
															Project contracts between the mine and the main contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks;	Prior to construction	Project Manager	Included in construction and planning costs

							appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force during the pre-construction, during construction and during full operation. It is recommended that training and skills development activities start during the construction period; • Ensure that local businesses, especially those of Historically Disadvantaged Individuals (HDI), women and of Small, Micro and Medium Enterprises (SMMEs) get allocated the maximum appropriate share of project related business opportunities; and • Ensure that the Labour Relations Amendment Act, 2002 (Act No. 12 of 2002) as well as the necessary policies and procedures are taken into consideration to ensure the correct procurement procedures.							Establish an employment information desk to assist with the day to day management of project related labour issues;	Prior to construction	Human Resources Manager	Included in construction and planning costs
														Develop a Recruitment Manual to include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on procedures to be followed by aspiring employment seekers.	Prior to operation	Human Resources Manager	Included in construction and operational costs
														Capture all project relevant skills in the project area with the aim to ensure maximum local employment;	Prior to operation	Human Resources Manager	Included in construction and operational costs
Conversion and diversification of economic activities		4	3	3	3	30	L	• Affected landowners must be consulted to establish means to continue farming practises, i.e. as part of a Local Economic Development project to supply the mine with produce; and • The establishment of new businesses should comply with zoning and local by-law requirements.	6	3	3	3	36	M	Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs
Employment creation and decrease in unemployment		4	3	3	3	30	L	• Non-locals should only be hired when specialist skills, which are not available locally, are required and local business providing such skills cannot be created. • Labour based construction methods should be used whenever practically possible; • Local residents and communities should be employed, wherever possible; • Local construction companies should be used whenever possible, especially for subcontracting work; and • Local suppliers should be used as far as possible.	6	4	3	3	39	M	Verify the details of potential employees in order to ensure that local labour is employed.	During operation	Human Resources Manager	Included in operating costs

Operational Phase: Social Change Process: Geographic processes																
Conversion and diversification of land use		6	4	3	4	52	M	• Educate landowners in terms of their rights and responsibilities prior to the project going ahead; • Integrate the mining area with regional land use planning objectives where possible; and • Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options.	4	4	3	4	44	M	Establish landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Prior to operation	Community Liaison Manager	Included in construction and operating costs
Transportation and rural accessibility		4	4	3	2	22	L	• Employ local labour as far as possible to limit the negative impacts on the infrastructure and services within the area (e.g. roads); • The applicant should, in liaison with the relevant Roads and Traffic Department, assist with the regular maintenance of the roads frequently used by construction and mine traffic; • Speed limits on the local roads surrounding the mining site should be enforced; and • Appropriate traffic management measures should be planned for and implemented, especially during the construction phase with the expected increase in heavy vehicle traffic.	6	4	3	3	39	M	Verify the details of potential employees in order to ensure that local labour is employed.	During operation	Human Resources Manager	Included in operating costs
Operational Phase: Social Change Process: Emancipatory and empowerment processes																
Capacity building (skills transfer)		6	2	3	4	44	M	• Recruit and train local residents to supply unskilled labour; • The local municipality could assist local residents and business owners to garner the benefit associated with the spin-offs emanating from the proposed mine; • Stakeholders should be mutually accountable for increased opportunities regarding skills and competency development (general education and technical training). This will enable active participation, not only in the construction sector, but also in other spheres of the economy, as well as providing opportunities for career enhancement; • Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere; • Implement recruitment program;	8	3	3	4	56	M	Use training manual	During operation	Human Resources Manager	Included in operating costs

								• Ensure that stakeholders have knowledge of the support of legislation and regulations; • The implementation of the SLP should be monitored on an annual basis; • Ensure compliance to the BBSEC and MPRDA; and • Ensure that the employment and training of HDSA and women meet the requirements of the BBSEC.										
Operational Phase: Social Change Process: Socio-cultural processes																		
Deviant social behaviour		6	3	2	3	33	M	• Require mine personnel to wear identification badges to distinguish them from trespassers or unwanted loiterers; • Liaise with the SAPD in order to implement effective crime prevention strategies; and • Liaise with existing forums in the community to communicate information to the community and to assist in the monitoring of compliance.	6	2	2	3	30	L	Communicate with landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Monthly	Environmental Officer	Included in construction and operating costs
Actual health		6	3	3	4	48	M	• In order to reduce the impact on the local community it is important to maximise the use of local labour as far as possible; • Local labour should be employed as far as possible to avoid additional pressure on the existing services; • HIV / Aids awareness campaigns should be initiated by The applicant and provided to all its mine employees on a regular basis; • The applicant should investigate how they could assist in implementing a	4	3	3	4	40	M	Verify the details of potential employees in order to ensure that local labour is employed.	During operation	Human Resources Manager	Included in operating costs

								community health awareness programme in liaison with the LM; • The necessary safety precautions should be taken and first aid supplies should be made available on site; • All mine employees (including contractors) should undergo health and safety training on a regular basis; • The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services; • The applicant, through consultation with the LM should investigate ways in which their LED programmes and infrastructure development component of their SLP can assist in improving the overall health services within the communities; and • The required safety equipment should be provided to employees as well as on site and should be in a good working order.							Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners.	During operation	Environmental Officer	Included in construction and operating costs
Feelings in relation to the project		6	3	3	3	36	M	• A comprehensive PPP should be implemented to effectively consult and involve the affected landowners and communities; • The applicant must be transparent about the areas they intend mining and the proposed mining method and technology.	6	2	3	2	22	L	Continuous consultation with the affected communities should take place to keep them informed.	Monthly	Environmental Officer	Included in construction and operating costs
Physical quality of the living environment			10	4	2	64	H	• Manage all impacts on the biophysical, heritage and cultural environment as per the EMP requirements; • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cove.	8	4	2	3	42	M	Communicate with landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	Monthly	Environmental Officer	Included in construction and operating costs
Aesthetic quality of the living environment		6	4	2	4	48	M	• The mine plan should not deviate from without assessing the potential impacts on the aesthetic quality of the environment.	4	4	2	4	40	M	N/A	N/A	N/A	N/A
Availability and quality of housing		8	4	3	4	60	H	• Employees should be educated with regards to their accommodation options; • Housing needs should be monitored and addressed in consultation and cooperation with the applicable LMs.	8	4	3	3	45	M	Maximise the employment of locals to limit the need for any additional housing infrastructure, as far as possible	During operation	Human Resources Manager	Included in operating costs

Adequacy of physical infrastructure		8	4	3	4	60	H	• The provision of infrastructural services must be integrated with the economic needs of the community; • Measures must be taken to address infrastructure development as part of future planning; • Promote local procurement of suppliers and contractors for the transport system.	6	4	3	3	39	M	The applicant, in liaison with the municipality should proactively plan for enough infrastructure and services to meet the maximum potential of the mine in terms of service and infrastructure demand.	During operation	Human Resources Manager	Included in operating costs
Adequacy and access to social infrastructure		6	3	2	3	33	M	• Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations; • Continuous involvement of the mine would be necessary and should be undertaken in a transparent and supportive man • Communication of the projects that the applicant would be involved in should filter through to all community levels to ensure maximum benefit to the community.	8	4	2	4	56	M	In consultation with the municipality and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine, take place.	During operation	Mine Management team.	Included in operating costs
															Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus;	During operation	Mine Management team.	Included in operating costs
Personal safety and hazard exposure		6	4	2	4	48	M	• Local, unemployed labour should be employed as far as possible; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; • The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Strict security measures should be put in place. Security personnel should be on site on	4	4	2	3	30	L	Verify the details of potential employees in order to ensure that local labour is employed.	During operation	Human Resources Manager	Included in operating costs

								a permanent basis; • The mining area should be fenced to avoid unauthorised entry by humans or animals onto the mining area; • Workers must not be allowed to overnight on the premises and must be transported to their places of residence by bus on a daily basis; • Workers must not be allowed to leave the designated mining areas without permission; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • The applicant should, in conjunction with the property owners, develop and implement emergency procedures; • Operational safety risks should be addressed as part of the OHS Act; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • Signs indicating hazardous storage areas, as well as areas where access is restricted should be placed on site.							A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses	During operation	Health and Safety Officer	Included in operating costs
Crime and violence		4	3	3	2	20	L	• Local, unemployed labour should be employed as far as possible; • The applicant must liaise with the LMs and labour unions to establish a protocol for ensuring community safety; • Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body.	4	2	3	2	18	L	Verify the details of potential employees in order to ensure that local labour is employed.	During operation	Human Resources Manager	Included in operating costs
															Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible.	During operation	Mine Management team.	Included in operating costs
Functioning of government agencies		6	3	3	3	36	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programmes.	8	4	3	4	60	H				
Impact equity		4	2	3	3	27	L	• Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution); • Safety and security measures are critical to avoid any increase in criminal activities within the local study area;	8	4	3	3	45	M	Comply with the EMP to manage environmental impacts	During operation	Environmental Officer	Included in operating costs

								• Skills training and development should be maximised to benefit as many local employees as possible; and • The use of local labour must be maximised as far as possible.							Verify the details of potential employees in order to ensure that local labour is employed.	During operation	Human Resources Manager	Included in operating costs
															Implement training manual	During operation	Human Resources Manager	Included in operating costs
Gendered division of labour		4	3	3	2	20	L	• Women must have equal employment opportunities; • Training and skills development should take place for women; • Salaries of women should be equal to that of men when undertaking the same job; • Commitments made in the SLP with regard to the employment of women should be adhered to; and • Institute a well designed gender equality strategy on the mine.	6	4	3	3	39	M	Institute a well designed gender equality strategy on the mine.	During all phases of the mine life cycle	Humana Resources/Mine Management	Including in construction and operating costs

7.4 Closure and Decommissioning Phase

This section comprises of the description of potential impacts associated with the closure, decommissioning and rehabilitation activities on the biophysical, socio-economic and heritage and cultural environment. These descriptions are followed by the impact tables which contain the assessment of the significance of each identified impact without, then with mitigation measures. Each mitigation measure proposed is assigned a proposed action plan, frequency, associated management cost, as well as person responsible for implementation of the mitigation measures proposed to mitigate and/or manage each impact.

7.4.1 Topography

The rehabilitation activities will aim to ensure that the disturbed areas are returned to as close to the natural topography of the area. No significant impacts on the topography are expected during this phase. The closure and decommissioning phases will aim to return the area to a free-draining system and will therefore have an overall positive impact on the topography.

As mentioned before, the risk of subsidence within the area designated for the Mukulu Mine surface layout has been identified as a risk. This risk cannot be quantified at this stage. It is recommended that a Geotechnical Investigation is commissioned prior to the start of construction to determine and quantify the risk.

7.4.2 Geology

No impacts on the geology are anticipated for the decommissioning and closure phase, or thereafter (post-closure).

7.4.3 Groundwater

No mine water decanting is expected to occur after mining operations have stopped.

Underground operations are allowed to flood during the decommissioning and closure phases, therefore this has not been identified as a significant impact.

The groundwater model must be updated with underground mine plan for the Olivewood and Belgravia orebodies and monitoring data gathered from the pre-construction phase and operational phase to determine the impacts after closure.

7.4.4 Surface water

Rehabilitation activities create the risk of soil erosion and contaminated runoff. This can easily be mitigated by maintaining the storm water management infrastructure throughout the rehabilitation of the mine until such a time that the rehabilitation is considered successful and the runoff from the area is no longer considered contaminated. Once this has been determined, the PCD, berms and channels may be rehabilitated to make the area free draining.

7.4.5 Wetland and Aquatics

There are no wetlands areas within 1 000m of any proposed surface infrastructure or shafts, therefore no wetlands will be impacted on by the decommissioning, rehabilitation and closure activities.

7.4.6 Terrestrial Biodiversity

The decommissioning and rehabilitation activities have the potential to impact of flora and fauna due to the activity and movement of people in the area, the creation of dust and the runoff of contaminated water.

These impacts can be mitigated by maintaining the management measures and procedures which were required by employees during the construction and operational phases regarding the identification and preservation of Red Data plant species and the careful handling of fauna. Other management measures such as dust suppression spraying; prohibiting activities outside of the demarcated mine area and the maintenance of storm water management infrastructure until rehabilitation is considered successful will minimize the impacts on flora and fauna.

7.4.7 Soil, Land use and Land Capability

Soils compaction may occur during this phase due to the movement of people and vehicles in the area, as well as spillages of hydrocarbons and chemicals which may occur during decommissioning activities.

This impacted will be managed by the ripping of compacted areas after the removal of infrastructure. Furthermore, topsoil will be placed over the disturbed areas and these will be vegetated. The vegetation cover will protect the soils from erosion in the long term.

7.4.8 Noise

The lack of an established settlement in the immediate vicinity of the proposed mine surface infrastructure means that there are few to no sensitive receptors. The creation of noise during the operational phase is therefore not considered significant.

7.4.9 Traffic

The transport of workers to and from the site, as well as vehicles carrying building rubble and waste produced during decommissioning activities will impact on the traffic and roads.

However, this impact is not considered significant as the traffic volumes will be far lower than those created during the operational phase of the mine (the impact on traffic during the operational phase is considered to be of low significance.

7.4.10 Air Quality

Dust will be created by the removal of infrastructure and the ripping of compacted areas. The lack of an established settlement in the vicinity of the mine and the limited duration of the activities mean that this impact will be of low significance.

Furthermore, this impact can be easily mitigated through dust suppression spraying of haul roads areas.

7.4.11 Heritage

The removal of infrastructure and rehabilitation of disturbed areas will create dust, which may impact on the graves and buildings identified in the vicinity of the surface infrastructure (Refer to Section 2.13). These impacts are considered to be of low significance as these sites not reasonably far from the proposed mining activities.

The impacts created by dust can be mitigated by the implementation of dust suppression spraying. Furthermore, a heritage management plan should be complied with. It is recommended that a heritage management plan is compiled by a heritage expert prior to the construction phase of the project. This should be updated during the life of mine should there be any changes to the mine plan.

7.4.12 Socio-economic

The following socio-economic impacts are envisaged during the closure and rehabilitation phase

- Conversion and diversification of economic activities
- Capacity building and skills transfer. The skill acquisition during the rehabilitation phase will probably be limited to on the job training. The significance of this impact is considered to be low due to the limited number of jobs during this phase and due to the temporary nature of the phase.
- Actual Health and Fertility
- Physical quality of the living environment (actual and perceived)
- Aesthetic quality of the living environment
- Adequacy of physical infrastructure / increased pressure on existing infrastructure
- Adequacy and access to social infrastructure
- Personal safety and hazard exposure
- Crime and violence
- Loss of natural and cultural heritage
- Functioning of government agencies
- Impact equity
- Gendered division of labour

7.4.13 Closure and Decommissioning Phase Impact Assessment and Management Programme

The impacts which are anticipated during the decommissioning and closure phase were assessed and the results of this assessment are presented in the tables which follow. Each table also includes the required action plan, frequency of the management measures, the associated costs per annum, as well as the person responsible for undertaking the required actions.

The construction phase impacts on the biophysical and heritage environment are described under sections 7.4.10.1 to 7.4.10.4.

Socio-economic impacts can be contributed to the overall mining operation and not just any particular construction activity to particular physical construction operational activities; therefore the socio-economic impacts associated with the construction operational phase are presented under Section 7.4.4.4.

7.4.13.1 Removal of Infrastructure

The potential impacts on the biophysical and heritage environment associated with the removal of infrastructure is presented in Table 7.18.

Table 7.18 Mukulu Mine Impact Assessment and Management Plan: Decommissioning Phase - Removal of Infrastructure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TO	SP		M	D	S	P	TOT	SP				
Decommissioning Phase: Removal of Infrastructure																		
Issues related to TOPOGRAPHY																		
No significant impacts envisaged	Removal of infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to GEOLOGY																		
None	Removal of infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Soil compaction	Transport to remove infrastructure	2	4	6	4	48	M	• Tracked vehicles are more desirable than wheeled vehicles due to their lower point loading and slip, while vehicle speed should be maintained in order to reduce the duration of applied pressure, thereby minimizing compaction; • Compacted soils must be ripped and re-vegetated.	1	5	4	4	40	M	Implement speed limits for all vehicles	During construction	Project Manager	Including in operating costs
															Ripping and topsoiling of disturbed areas	Prior to decommissioning	Project Manager	Included in rehabilitation cost for general surface rehabilitation R 1 749 939.00
Chemical soil pollution	Spillage of used hydrocarbons or chemicals	8	2	2	5	60	H	• All chemicals should be stored in bunded areas with a capacity of no less than 110% of the content; • Should vehicles be serviced on site, this has to be undertaken in surfaced and contained areas; • In addition to the above, drip trays should be utilised; • A comprehensive Material • Safety Data Sheet list will be drawn up of all chemicals stored on site. • Contaminated soils must be managed as hazardous material; • Accidental spillage must be minimised and contained; • The spilled substance must be captured and stored in a suitable container within a	4	2	2	4	32	M	Conduct environmental induction for workers	Prior to decommissioning	Project Manager	N/A
															Provide spillkits at all area on site	During construction	Contractor	Spillkit- R22 000
															Manage spill according to the Environmental Awareness and Emergency Response Plan	After spillage	Environmental Coordinator	To be determined based on severity of spillage

							bunded area; • Determine the depth and width that the oil/diesel has penetrated into the soil as far as possible, by digging up the polluted soil (excavating); and • Remove the polluted ground to one side and mix it thoroughly with the bioremediation powder; • • All fluids must be contained within properly constructed enclosure with concrete flooring; • Fuel tanks should be placed and operated such that accidental spillage potential is minimized and contained.							Monitor remediated area to determine if remediation has been successful	After spillage	Environmental Control Officer	Included in Aftercare Monitoring and Maintenance R245 326.50
Issues related to Wetlands																		
No wetlands fall within 1000m of the indicated surface infrastructure areas and shaft localities, so the project will not contribute to any further wetland loss.	Removal of infrastructure	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to Fauna													•					
None	Removal of infrastructure	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FLORA																		
Direct impacts on flora species of conservation importance	Removal of infrastructure	8	4	2	3	42	M	• Prohibit activities outside of the footprint area; • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures; • Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; • The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard and should be guided by safe practice guidelines; • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.	6	4	2	2	24	L	Conduct environmental induction for workers Provide fire extinguishers at all areas of the site	Prior to decommissioning During decommissioning activities	Project Manager Project Manager	Including in operating costs Including in operating costs

Loss or degradation of natural vegetation/ pristine habitat	Removal of infrastructure	6	4	2	3	36	M	• Prohibit activities outside of the footprint area • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures.	4	4	2	3	30	L	Conduct environmental induction for workers	Prior to decommissioning	Project Manager	Including in operating costs Including in operating costs
															Provide fire extinguishers at all areas of the site	During decommissioning activities	Project Manager	
Direct impacts on ecological connectivity & ecosystem functioning	Removal of infrastructure	6	4	2	3	36	M	• Prohibit activities outside of the footprint area • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures.	4	4	2	3	30	L	Conduct environmental induction for workers	Prior to decommissioning	Project Manager	Including in operating costs
															Provide fire extinguishers at all areas of the site	During decommissioning activities	Project Manager	Including in operating costs
Loss/ degradation of surrounding habitat	Removal of infrastructure	6	4	2	2	24	L	• Prohibit activities outside of the footprint area • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures.	4	4	2	2	20	L	Conduct environmental induction for workers	Prior to decommissioning	Project Manager	Including in operating costs
															Provide fire extinguishers at all areas of the site	During decommissioning activities	Project Manager	Including in operating costs
Increase in local and regional fragmentation/ isolation of habitat	Removal of infrastructure	4	4	2	2	20	L	• Prohibit activities outside of the footprint area • Prevent contamination of natural habitat from any source of pollution; • Prohibit all open fires; • Provide demarcated fire-safe zones, facilities and suitable fire control measures.	4	4	2	1	10	L	Conduct environmental induction for workers	Prior to decommissioning	Project Manager	Including in operating costs
															Provide fire extinguishers at all areas of the site	During decommissioning activities	Project Manager	Including in operating costs
Increase in alien invasive plants	Product Stockpiling	6	5	2	4	52	M	• A detailed weed management programme will be established and enforced on the mine; • The monitoring of invasive species will be undertaken on a scheduled timeframe and will be allocated to a specific responsible person	6	5	2	3	39	M	Compile weed/alien plant eradication programme.	During construction	Environmental Coordinator	Included in construction cost
															Implement a weed and alien invasive species eradication programme during the life of the mine all areas. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings.	Monthly	Environmental Officer	Included in rehabilitation assessment R96 000.00

Issues related to AIR QUALITY																		
Creation of dust	Removal of infrastructure	4	2	2	3	24	L	• Implement dust suppression spraying where necessary; • Limit the movement of vehicle to established haul roads as far as possible.	4	2	2	2	16	L	Implement air quality monitoring programme	During and after decommissioning activities	Environmental Coordinator with air quality specialist	R90 000
															Provide dust suppression equipment and water.	During decommissioning activities	Contractor	Included in rehabilitation cost R28 587 585.84
Issues related to SURFACE WATER																		
Contamination from dirty runoff	Closure	2	2	2	2	12	L	• Storm water Management Plan maintained until after rehabilitation • All clean and dirty water systems will remain up until all contaminated sources have been removed.	2	1	2	1	5	L	N/A	N/A	N/A	N/A
Issues related to GROUNDWATER																		
None	Removal of infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to HERITAGE AND ARCHAEOLOGY																		
Heritage - Graves site 2, 3, 6	Dust	8	4	2	4	56	M	• Implement dust suppression spraying where necessary; • Limit the movement of vehicle to established haul roads as far as possible.	4	4	2	2	20	L	Implement air quality monitoring programme	During and after decommissioning activities	Environmental Coordinator with air quality specialist	R90 000
															Provide dust suppression equipment and water.	During decommissioning activities	Contractor	Included in rehabilitation cost R28 587 585.84
Heritage - Buildings site 1, 4, 5, 7, 8, 11	Dust	8	4	2	4	56	M	• Implement dust suppression spraying where necessary; • Limit the movement of vehicle to established haul roads as far as possible.	4	4	2	2	20	L	Implement air quality monitoring programme	During and after decommissioning activities	Environmental Coordinator with air quality specialist	R90 000
															Provide dust suppression equipment and water.	During decommissioning activities	Contractor	Included in rehabilitation cost R28 587 585.84
Issues related to NOISE																		
No significant impacts envisaged	Removal of infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Removal of infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
None	Removal of infrastructure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.4.13.2 Rehabilitation

The potential impacts on the biophysical and heritage environment associated with the removal of infrastructure is presented in Table 7.19.

Table 7.19 Mukulu Mine Impact Assessment and Management Plan: Decommissioning Phase - Rehabilitation

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TO	SP		M	D	S	P	TOT	SP				
Decommissioning Phase: Rehabilitation																		
Issues related to TOPOGRAPHY																		
Positive impact on topography	Rehabilitation activities	6	5	3	4	56	+M	The area will be shaped to be free-draining.	6	5	3	4	56	+M	Undertake rehabilitation in compliance with rehabilitation plan	During decommissioning activities	Project Manager	Included in rehabilitation cost R28 587 585.84
Issues related to GEOLOGY																		
No significant impacts envisaged	Rehabilitation activities	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
Improved soil conditions	Rehabilitation activities	6	5	3	4	56	+M	• Topsoil will be sampled to determine the quality thereof. A soil specialist will be involved to fertilise the soils where required; • All compacted areas will be ripped and ameliorated where required; • Rehabilitated areas will be fenced off up until it is determined that the landscape is stable.	6	5	3	4	56	+M	Undertake rehabilitation in compliance with rehabilitation plan	During decommissioning activities	Project Manager	Included in rehabilitation cost R28 587 585.84
Issues related to WETLANDS																		
No wetlands fall within 1 000m of the indicated surface infrastructure areas and shaft localities, thus no impact expected	Rehabilitation activities	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
No significant impacts envisaged	Rehabilitation activities	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FLORA																		
Improvement of vegetation	Rehabilitation activities	6	5	3	4	56	+M	• The rehabilitation activities will be undertaken in such a manner to promote the self succession of vegetation. • Should it be found that self-succession is not taking place the mine will investigate manners (such as vegetating the area) to promote a seedbed formation; • The weed management programme will be maintained up until closure is obtained; • Rehabilitated areas will be fenced off up until it is determined that the landscape is stable.	6	5	3	4	56	+M	Implement a weed and alien invasive species eradication. Audit the alien invasive management plan, and remove alien invasive species vegetation as per the findings. Implement after care rehabilitation monitoring	Monthly Monthly	Environmental Officer Environmental Officer	Included in rehabilitation assessment R96 000.00 Included in rehabilitation assessment R96 000.00

Issues related to AIR QUALITY																		
No significant impacts envisaged	Rehabilitation activities	0	0	0	0	0	L	Dust monitoring will continue up until such time as closure is obtained.	0	0	0	0	0	L	Dust monitoring	Monthly	Environmental Officer	R90 000
Issues related to SURFACE WATER																		
Contaminated runoff	Rehabilitation activities	2	2	2	2	12	L	• Storm water Management Plan will be maintained until rehabilitation activities have been completed and the area is regarded as stable. • At that stage, the infrastructure will be removed and the area will be shaped to ensure free-drainage.	2	1	2	1	5	L	N/A	N/A	N/A	N/A
Issues related to GROUNDWATER																		
None	Rehabilitation activities	0	0	0	0	0	L	Groundwater monitoring will continue up until closure has been obtained.	0	0	0	0	0	L	Implement groundwater monitoring programme	Monthly	Environmental coordinator and groundwater specialist	R 160 000
Issues related to HERITAGE AND ARCHAEOLOGY																		
Heritage - Graves site 2, 3, 6	Dust	8	4	2	4	56	M	• Implement dust suppression spraying where necessary; • Limit the movement of vehicle to established haul roads as far as possible.	4	4	2	2	20	L	Implement air quality monitoring programme	During and after decommissioning activities	Environmental Coordinator with air quality specialist	R90 000
															Provide dust suppression equipment and water.	During decommissioning activities	Contractor	Included in rehabilitation cost R28 587 585.84
Heritage - Buildings site 1, 4, 5, 7, 8, 11	Dust	8	4	2	4	56	M	• Implement dust suppression spraying where necessary; • Limit the movement of vehicle to established haul roads as far as possible.	4	4	2	2	20	L	Implement air quality monitoring programme	During and after decommissioning activities	Environmental Coordinator with air quality specialist	R90 000
															Provide dust suppression equipment and water.	During decommissioning activities	Contractor	Included in rehabilitation cost R28 587 585.84
Issues related to NOISE																		
No significant impacts envisaged	Rehabilitation activities	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
No significant impacts envisaged	Rehabilitation activities	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
No significant impacts envisaged	Rehabilitation activities	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.4.13.3 Residual Impacts Post Closure

The residual impacts which may remain after closure of the mine, as well as proposed mitigation and management measures thereto, are described in Table 7.20.

Table 7.20 Mukulu Mine Impact Assessment and Management Plan: Decommissioning Phase - Residual Impacts Post Closure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOT	SP		M	D	S	P	TOT	SP				
Decommissioning Phase: Residual Impacts Post Closure																		
Issues related to TOPOGRAPHY																		
Risk of subsidence	Residual Impacts Post Closure	10	5	1	5	80	H	• The risk of subsidence has not been established. It is recommended that a Geotechnical Investigation is commissioned prior to the establishment of infrastructure on Mukulu 265 to determine if the risk exists. • All safety pillars and structures will maintain within the underground mining sections to ensure stability.	4	2	1	1	7	L	Appoint specialist to undertake Geotechnical Investigation	Prior to construction	Project Manager	Will be determined once a tender is approved for the study
Changes in landscape	Residual Impacts Post Closure	6	5	2	4	52	M	• The paste disposal facility and waste rock dumps will be design with the aim of closure and as a result there will be a permanent change to the landscape but to such an extent that the area will remain free draining. • Erosion control measures will be key to ensure that the slopes can facilitate self-succession	6	5	2	4	52	M	Engineering and rehabilitation designs (of PDF and waste rock dump) to resemble the natural topography.	Prior to construction	Mining Engineer	Including in planning phase
Issues related to GEOLOGY																		
No significant impacts envisaged	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SOILS, LAND USE AND LAND CAPABILITY																		
No significant impacts envisaged	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to WETLANDS																		
None expected.	Residual Impacts Post Closure	0	0	0	0	0	L	None required.	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to FAUNA																		
No significant impacts envisaged	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

Issues related to FLORA																		
No significant impacts envisaged	Residual Impacts Post Closure	0	0	0	0	0	L		4	4	2	1	10	L	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																		
None	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to SURFACE WATER																		
None	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L				
Issues related to GROUNDWATER																		
Recovery of groundwater levels in underground.	UG areas post closure	2	3	2	4	28	L	No mitigation is possible.	2	3	2	4	28	L	N/A	N/A	N/A	N/A
Poor quality leachate from Slimes dam	Spreading of contaminant plume	2	3	1	3	18	L	Nitrate concentration will decrease over time due to leaching by infiltrating rainwater.	2	3	1	2	12	L	N/A	N/A	N/A	N/A
Issues related to HERITAGE AND ARCHAEOLOGY																		
None	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to NOISE																		
None	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																		
None	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A
Issues related to VISUAL																		
None	Residual Impacts Post Closure	0	0	0	0	0	L	None required	0	0	0	0	0	L	N/A	N/A	N/A	N/A

7.4.13.4 Socio-economic Impacts

The impact of the decommissioning and closure of the mine on the socio-economic environment is described in Table 7.21.

Table 7.21 Mukulu Mine Impact Assessment and Management Plan: Decommissioning Phase – Socio-economic impacts

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TO	SP		M	D	S	P	TOT	SP				
Decommissioning Phase: Social Change Process: Geographic processes																		
Conversion and diversification of land use		4	3	3	3	30	L	• Educate landowners in terms of their rights and responsibilities prior to the project going ahead; • Integrate the mining area with regional land use planning objectives where possible; and • Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options.	6	3	3	3	36	M	Communicate with landowner forum/environmental committee with landowners within the MRA and surrounding areas to discuss various issues	During decommissioning	Community Liaison Manager	Included in operating costs
Decommissioning Phase: Social Change Process: Emancipatory and empowerment processes																		
Capacity building (skills transfer)		6	2	3	4	44	M	• Training programs should continue during this phase; • Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere; • Use of the program for recruiting, hiring, training, orienting and counselling which was established prior to the operational phase.	8	3	3	4	56	M	Implement training programme	During decommissioning	Contractor/Project Manager	Included in operating costs
Decommissioning Phase: Social Change Process: Socio-cultural processes																		
Actual health		6	3	3	4	48	M	• In order to reduce the impact on the local community it is important to maximise the use of local labour as far as possible; • Local labour should be employed as far as possible to avoid additional pressure on the existing services; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • The necessary safety precautions should be taken and first aid supplies should be made available on site; • The required safety equipment should be provided to employees as well as on site and should be	4	3	3	4	40	M	Ensure that contractor appointed employs local labour as far as possible	Prior to decommissioning phase	Project Manager	Included in operating costs

								in a good working order.									
Physical quality of the living environment		10	4	2	4	64	H	• Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented.	8	4	2	3	42	M	Implement after care rehabilitation monitoring	Monthly	Environmental Officer	Included in rehabilitation assessment R96 000.00
Aesthetic quality of the living environment		6	4	2	4	48	M	• Monitoring after rehabilitation should be done until the rehabilitation is considered successful.	4	4	2	4	40	M	Implement after care rehabilitation monitoring	Monthly	Environmental Officer	Included in rehabilitation assessment R96 000.00
Availability and quality of housing		8	4	3	4	60	H	• Maximise the employment of locals to limit the need for any additional housing infrastructure, as far as possible.	8	4	3	3	45	M	Ensure that contractor appointed employs local labour as far as possible	Prior to decommissioning phase	Project Manager	Included in operating costs
Personal safety and hazard exposure		6	4	2	4	48	M	• Local, unemployed labour should be employed as far as possible; • Workers must not be allowed to overnight on the premises and must be transported to their places of residence by bus on a daily basis; • Workers must not be allowed to leave the designated mining areas without permission; • Implement Health and Safety Plan; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • Implement Fire Management Plan; • Open fires for cooking and related purposes should not be allowed on site; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • Speed limits on the local roads surrounding the construction sites should be enforced; and • Speeding of construction vehicles must be strictly monitored.	4	4	2	3	30	L	Ensure that contractor appointed employs local labour as far as possible	Prior to decommissioning phase	Project Manager	Included in operating costs
															A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses;	During decommissioning	Project Manager	Included in operating costs
Crime and violence		4	3	3	2	20	L	• Local, unemployed labour should be employed during this phase as far as possible.	4	2	3	2	18	L	Ensure that contractor appointed employs local labour as far as possible	Prior to decommissioning phase	Project Manager	Included in operating costs
Functioning of government agencies		6	3	3	3	36	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programmes.	8	4	3	4	60	H	Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible.	During operation	Mine Management	Included in construction and planning costs
Impact equity		4	2	3	3	27	L	• Manage environment and heritage impact through strict adherence to the EMP;	8	4	3	3	45	M	Ensure compliance with the management measures in the approved EMP	During construction	Environmental Coordinator/Project Manager/Contractor	Included in construction and operating costs

							• Safety and security measures are critical to avoid any increase in criminal activities within the local study area; • The use of local labour must be maximised as far as possible.							Ensure that contractor appointed employs local labour as far as possible	Prior to construction	Project Manager	Included in construction and planning costs
Gendered division of labour		4	3	3	2	20	L	• Women must have equal employment opportunities; • Training and skills development should take place for women.	6	4	3	3	39	M	Institute a well designed gender equality strategy on the mine.	During all phases of the mine life cycle	Humana Resources/Mine Management	Including in construction and operating costs

8 MONITORING AND AUDITING

This chapter of the reports fulfills the requirements of section 50 (h) and 51 (b) of the MPRDA Regulation R527, as listed under the EMP template:

REGULATION 50 (h):

- *(Section 1- 15): Arrangements for monitoring and management of environmental impacts:*
  - *(Section 1 - 15.1): List of identified impacts which will require monitoring programmes;*
  - *(Section 1 - 15.2): Functional requirements for the said monitoring programmes; and*
  - *(Section 1 - 15.3): Roles and responsibilities for the execution of the monitoring programmes;*
  - (Section 1 - 15.4): Time frames for monitoring and reporting.

REGULATION 51 (b):

- *(Section 2 – 8): Planned monitoring and environmental management programme performance assessment:*
  - *(Section 2 - 8.1): Description of planned monitoring of the aspects of the environment which may be impacted upon. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department);*
  - *(Section 2 - 8.2): Provide a description as to how the implementation of the action plans contemplated in regulation 51 (b) (ii) as described will be monitored as described in paragraph 6 of the EMP will be monitored;*
  - *(Section 2 - 8.3): Frequency of proposed reporting for assessment purposes.*

Furthermore, Regulation 55 (1) (2) of the MPRDA Regulations, R527 require that the holder of a mining right conduct monitoring on a continuous basis.

8.1 Surface Water Monitoring Programme

Due to the fact that all dirty water contained will be utilized in the mine process it is recommended that all dirty water systems be monitored monthly. This requires that samples are taken from each dirty water dam at the proposed Mukulu Mine and these are sent to an accredited laboratory for testing.

The water quality parameters for which the samples should be tested should include the following, as well as any other parameters required by DWA in the WUL:

- Electric Conductivity;
- pH;
- Total Dissolved Solids;
- Suspended Solids;
- Total Hardness;
- Total Alkalinity;
- Calcium;
- Magnesium;
- Sodium;
- Potassium;
- Chloride;
- Sulphate;
- Fluoride;
- Nitrate;
- Iron;
- Manganese.

No monitoring of surface water resources is recommended, as surface water over the entire project area and surrounds is a temporal occurrence only after heavy rains.

The storm water management measure must, however be maintained to ensure that that they are effective.

Main Street will appoint an independent and competent specialist to undertake the sampling of the dirty water dams, and prepare quarterly reports, as well as an annual report for submission to the mine. The mine will keep a copy and submit one to the DWA on a quarterly basis.

8.2 Groundwater Monitoring Programme

8.2.1 Purpose and Objectives of Groundwater Monitoring

The objective of a groundwater monitoring program is to detect any changes that the mining activities may have on water quality and levels in the area over time. Accurate record keeping of monitoring data will assist with the updating of the groundwater model of the mine over time.

The monitoring programme will also aid the mine management team to identify where non-compliances have occurred and where mitigation and management measures need to be improved.

Groundwater monitoring assessment should include the following:

- The impact of mine dewatering on the surrounding aquifers. This will be achieved through monitoring of groundwater levels in the open exploration boreholes e.g. MKA 6, MKA 10, MKA 11, MKA 12 & MKA 13;
- Although no private boreholes were identified within the zone/s of impact on groundwater levels or quality, it is recommended that the private boreholes be included in the groundwater monitoring programme;
- Groundwater inflow into the underground mine workings: This will be achieved through monitoring of groundwater levels in the monitoring boreholes as well as measuring water volumes pumped from mining areas;
- Groundwater quality trends: This will be achieved through sampling of the groundwater in the boreholes at the prescribed frequency.

8.2.2 Groundwater Monitoring Points

The groundwater monitoring program will include the three newly-drilled boreholes, five of the existing exploration boreholes (MKA 6, MKA 10, MKA 11, MKA 12 & MKA 13) as well as some of the private boreholes in the neighbouring area.

The proposed groundwater monitoring points are described in Table 8.1 and shown in Figure 8.1.

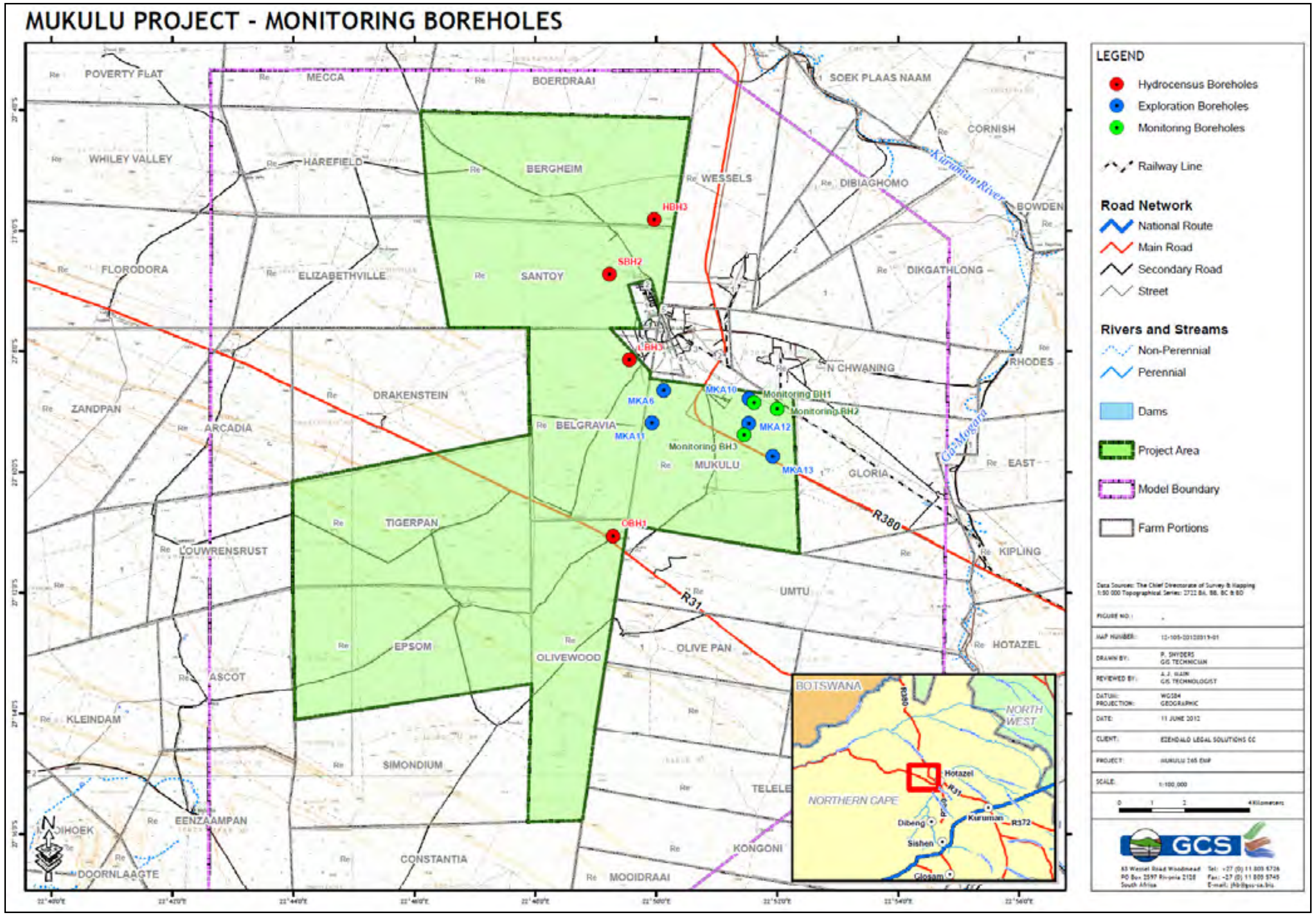
Table 8.1 Proposed Groundwater Monitoring Points

BOREHOLE ID	SOUTH	EAST
OBH1	27°-8'-38.7"S	22°50'7"E
BBH3	27°-8'-47"S	22°51'31.9"E
HBH3	27°-9'-11.2"S	22°49'55.7"E
SBH2	27°-9'-11.7"S	22°51'31.6"E
MKA6	27°-9'-44.2"S	22°51'55.5"E
MKA10	27°-8'-50.7"S	22°51'36.8"E
MKA11	27°-8'-57.3"S	22°51'59.9"E
MKA12	27°-9'-23"S	22°51'26.7"E
MKA13	27°-8'-8.3"S	22°49'33.1"E
Monitoring BH1	27°-6'-43.4"S	22°49'13.4"E
Monitoring BH2	27°-11'-3.8"S	22°49'17"E
Monitoring BH3	27°-5'-48.9"S	22°49'57.8"E

The boreholes in the monitoring network will cover contaminant sources, receptors and potential contaminant plumes. Furthermore, monitoring of the background water quality and levels is also required.

It is recommended that monitoring take place prior to the construction phase to establish the baseline conditions of the groundwater resources within and around the Mukulu Mine area.

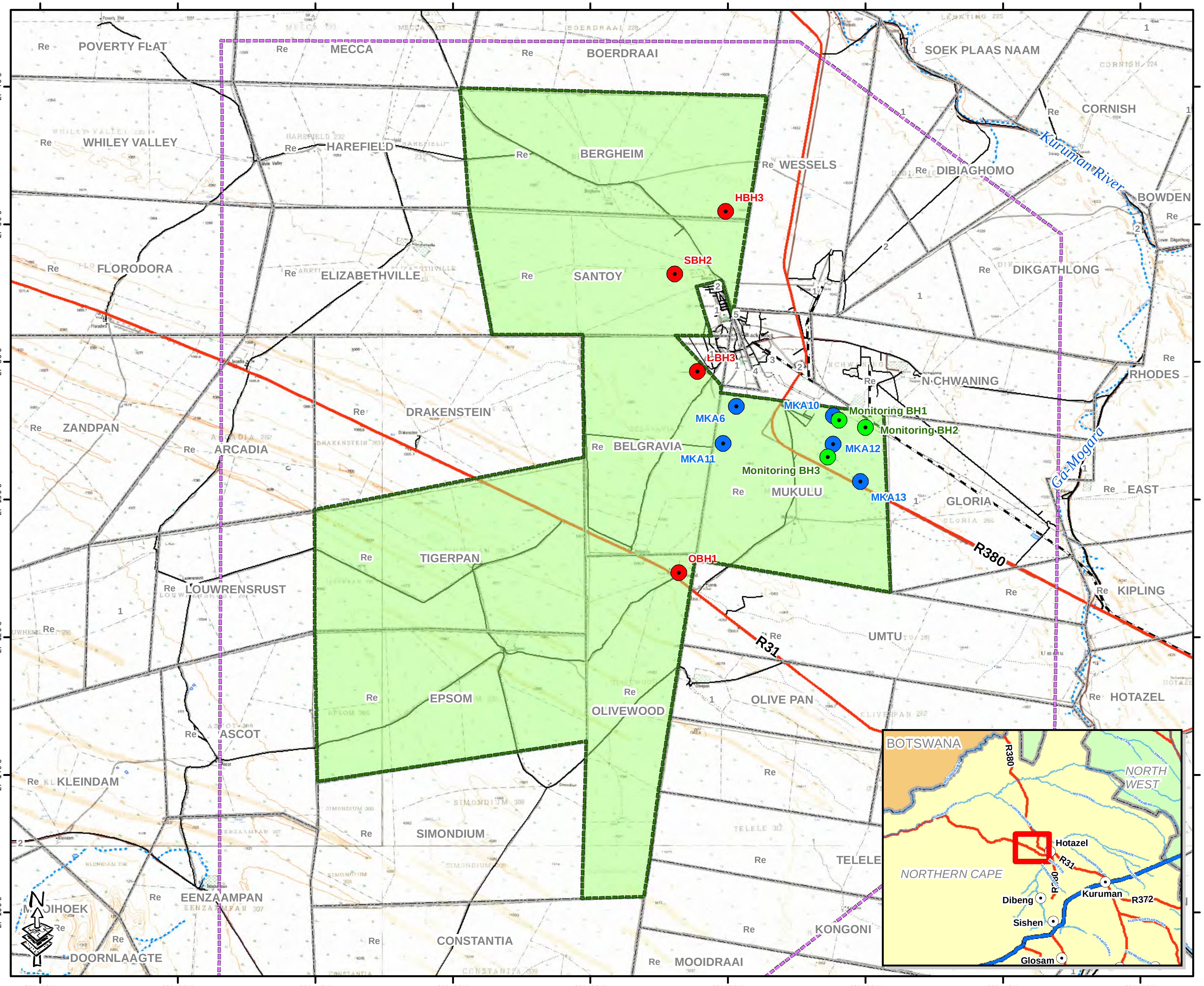
A water management forum will be established between Mukulu, the surrounding mines, municipality, DWA and landowners to discuss the status of water resources in the area and present the water monitoring result quarterly.



[Figure not to scale- refer to A3 map attached]

Figure 8.1 Mukulu Mine Groundwater Monitoring Points

MUKULU PROJECT - MONITORING BOREHOLES



BOTSWANA
NORTH WEST
NORTHERN CAPE
Hotazel
Dibeng
Sishen
Kuruman
Glosam
R380
R31
R372

LEGEND

- Hydrocensus Boreholes
- Exploration Boreholes
- Monitoring Boreholes
- Railway Line

Road Network

- National Route
- Main Road
- Secondary Road
- Street

Rivers and Streams

- Non-Perennial
- Perennial
- Dams
- Project Area
- Model Boundary
- Farm Portions

Data Sources: The Chief Directorate of Survey & Mapping 1:50 000 Topographical Series: 2722 BA, BB, BC & BD

FIGURE NO.:	-
MAP NUMBER:	12-105-20120319-01
DRAWN BY:	P. SNYDERS GIS TECHNICIAN
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	11 JUNE 2012
CLIENT:	EZENDALO LEGAL SOLUTIONS CC
PROJECT:	MUKULU 265 EMP
SCALE:	1:100,000

0 1 2 4 Kilometers

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8.2.3 Monitoring Parameters

Groundwater monitoring must undertaken according to SABS and DWA requirements as per the schedule presented in Table 8.2.

Table 8.2 Mukulu Mine Groundwater Monitoring Schedule

MONITORING POSITION	SAMPLING INTERVAL	ANALYSIS	WATER QUALITY STANDARDS
Construction, Operational, Decommissioning and Post Closure Phases			
All monitoring boreholes	Monthly: measuring the depth of groundwater levels	N/a	N/a
All monitoring boreholes	Quarterly: sampling for water quality analysis	Full analysis in January, April, July and October	South African Water Quality Guidelines: Domestic Use, Livestock Watering
Rainfall	Daily at the mine	N/a	N/a

The identification of the monitoring parameters is crucial and depends on the chemistry of possible pollution sources. They comprise a set of physical and/or chemical parameters (e.g. groundwater levels and predetermined organic and inorganic chemical constituents).

Physical Parameters:

- Groundwater levels

Chemical Parameters:

- Field measurements: pH, EC;
- Laboratory analyses: Anions and cations (Ca, Mg, Na, K, NO3, Cl, SO4, F, Fe, Mn, Al, As, V, Sr, Pb, Zn, NH4 & Alkalinity); Other parameters (pH, EC, TDS);
- Petroleum hydrocarbon contaminants (where applicable, near workshops and petroleum handling facilities); and
- Sewage related contaminants (E. coli, faecal coliforms) in boreholes in proximity to septic tanks or sewage plants.

Laboratory analysis techniques should comply with SABS guidelines. The groundwater monitoring database will 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 will be compiled and submitted to the authorities for evaluation and comment.

This report will be submitted annually for the construction, operational and decommissioning phases as well as for two (2) years after mining ceases. The mine will develop a monitoring response protocol after the completion of the Construction Phase of the project. This protocol will describe procedures in the event that groundwater monitoring information indicates that action is required.

Main Street will appoint an independent and competent person to undertake the required groundwater monitoring. The specialist will compile the necessary reports for submission to the proposed mine for record purposes and to be submitted to DWA on a quarterly basis.

8.3 Terrestrial Ecology: (Biodiversity)

The monitoring of the terrestrial ecology of the project area will involve the monitoring of:

- Vegetation;
- Animal life; and
- Soils.

Monitoring of these three components must be undertaken during all three phases of the mine life cycle. Monitoring is particularly important during the Decommissioning and Closure Phase as the success of the rehabilitation measures need to be confirmed.

It is recommended that an environmental monitoring programme is compiled and implemented with the aim of ensuring long-term success of rehabilitation and prevention of environmental degradation. Biodiversity monitoring should be conducted at least twice per year (summer and winter) in order to assess the status of natural habitat and effects of the development on the natural environment.

Compile progress reports on a regular basis, with input from the Site Manager, for submission to the Project Manager, including a final post-construction audit carried out by an independent auditor/consultant.

These reports will be submitted to the mine's Environmental Coordinator. The reports will be used to determine if rehabilitation efforts have been effective, if non-compliance with the EMP has occurred, and if further efforts need to be made to reach the environmental objectives of the mine.

8.3.1 Flora Monitoring

The objective of the vegetation monitoring programme is to minimise the extent of the impact of removal of vegetation and to limit the impact on any rare or endangered plants identified in the area of surface disturbance.

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) requires that all declared alien weeds and declared invader plants must be effectively controlled. The monitoring programme for vegetation will form the foundation for this objective, allowing for the identification of problem areas.

The program will also include the monitoring of the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources as required by the CARA. This must be addressed on a continual basis.

8.3.2 Disturbed Areas -Visual assessment

Visual assessments of disturbed areas will have to be made during the monitoring process. Designated and appropriately trained personnel will make field inspections, walking through disturbed areas to visually assess the presence of weeds and alien invader plants. These visual assessments should be performed monthly during the spring and summer months (September to February) and every two months during the autumn and winter months (March to August).

Record will be kept of the visual assessment stating the following minimum information:

- Date of visual assessment;
- Position of visual assessment (GPS co-ordinates or Grid number);
- Extent of disturbed area;
- Level of vegetation cover;
- Presence of rare and endangered plant species;
- Degree of establishment of alien and invasive species; and
- Photos of area.

The recorded data will be entered into an electronic database for report writing purposes with the hard copies of the field assessment forms being kept on file. Reporting on the status of the vegetation cover will be done on a quarterly basis. These reports will be submitted to the management at the mine together with information on how any problems were addressed. Should areas of concern be identified with rare or endangered species, or if areas are prone to the establishment of alien and invader species, the necessary mitigation measures should be implemented to address the problem.

8.3.3 Fauna Monitoring Objectives

The objective of a fauna monitoring programme is to minimise the extent of the impact of mining and related activities on the animal life of the area. The most important impacts on animal life that can be monitored during the operational phase of the proposed mine is the danger caused by traffic on the roads as well as the threat of poaching and killing of dangerous animals such as snakes.

8.3.4 Soils monitoring

Soil monitoring will involve the inspection of soil which has been disturbed, compacted, contaminated or eroded. Soil monitoring will assist in determining where soils have not been sufficiently rehabilitated.

Where soils have contaminated by the spillage of hydrocarbon, monitoring must take place on a weekly basis for at least four (4) weeks or until the soil is considered sufficiently rehabilitated. Soils samples should be taken and submitted to a laboratory to test for contaminant content if it is considered necessary.

Soil monitoring should be undertaken during the following periods:

- Areas which have rehabilitated following construction;
- After remediation soils which have been contaminated by spillages during the operational phase; and
- After the Closure and Decommissioning Phase.

8.4 Aquatic Ecology (Biomonitoring)

No aquatic biomonitoring is recommended for the Mukulu Mine, as there is no sustained water flow and no surface water resources (streams, wetlands, pans, etc.) within 1000m of any of the proposed shafts or surface infrastructure.

8.5 Air Quality

Dust monitoring is required to establish the baseline air quality conditions prior to construction and to monitor the impacts of dust creation due to soil stripping, and stockpiling activities (waste rock dumps, RoM stockpile and product stockpiles).

A minimum of three (3) dust fallout buckets will be located within the project area:

- A twin-directional dust bucket on the south-western border of the Mukulu mining area on Mukulu 265. Due to the fact that the prevailing wind direction is north-west, this will assist in establishing dust sources from outside of the mining area; and
- Twin-directional dust buckets should be placed at the north-western and north-eastern corners of the Mukulu mining area to determine the impacts of the proposed mine on the air quality.

The dust buckets will be replaced on a monthly basis and the dust bucket collected will be sent to an accredited laboratory for analysis.

Main Street will appoint an independent, competent specialist to undertake the placement of dust buckets. Dust buckets will be replaced monthly by the Mukulu mine staff and sent to the laboratory.

8.6 Monitoring Reports

Monitoring reports must be produced on a quarterly basis and submitted to the mine management team. The report will also be submitted to the DWA, as required by the Water Use License. (IWUL will be submitted to DWA).

8.7 Data Management

Water quality monitoring results must be stored on a database. This database will be utilized to update the groundwater model and to determine the groundwater quality trends over time.

Trend analysis will also assist to determine if additional management measures are required.

It is important that the database is kept updated and that access to the database is properly controlled to maintain the integrity of the data.

8.8 Performance Assessment /Audit

Performance assessment audits are required in terms of Regulation 55 (1) of the MPRDA Regulations, R527. In order to comply with this regulation, the following will be undertaken:

- Monitoring which will be conducted on an ongoing basis;
- Performance assessments of the environmental management programme annually, with an external performance assessment audit every two (2) years or as agreed by the Minister in writing. The annual performance assessment will be undertaken by a suitably qualified person, while the audit will be undertaken by an external, independent third party;
- Submission of a performance assessment report to the Director: Minerals.

9 ENVIRONMENTAL AWARENESS AND EMERGENCY RESPONSE PLAN

This chapter fulfils the requirements as per Regulation 51 (b) (iii) of the MPRDA Regulation R527 and headings 7 and 10 of the EMP Template.

REGULATION 51 (B) *– Outline of the implementation programme.*

- (*Section 7) Procedures for environmentally related emergencies and remediation (An environmental emergency plan that includes all the items referred to in the concomitant section of the guideline posted on the official website of the Department)*
- *(Section 10): Environmental Awareness Plan (Section 39 (3) (c)) (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department).*

The environmental awareness plan is required in terms of Section 39 (3) (c) of the MPRDA:
"An applicant who prepares an environmental management programme or an environmental management plan must –

(c) develop an environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment".

The purpose of this chapter of the EMP is to set out procedures to be followed during and after various types of incidents and accidents. It also sets out the procedure for inducting employees and informing all mine employees and contractors of the various risks which may results from the various activities on site and all required management and mitigation measures which are in place and that must be complied with in order to avoid environmental pollution and degradation.

The Environmental Awareness and Emergency Response Plan is attached under Appendix E.

10 FINANCIAL PROVISION FOR CLOSURE

This chapter of the report fulfills the requirements as per section 41 and 45 of the MPRDA and Regulation 53 and 54 of the MPRDA Regulation R527 and heading 9 of the EMP Template.

EMP Template:

- *(Section 2 – 9): Financial provision in relation to the execution of the environmental management programme:-*
  - *(Section 2 - 9.1): Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes anticipated. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department)(Refer to* Figure 3.1*);*
  - *(Section 2 - 9.2): Annual forecasted financial provision calculation (Refer to the concomitant section of the EIA and EMP guideline);*
  - *(Section 2 - 9.3): Confirmation of the amount that will be provided should the right be granted;*
  - *(Section (2 - 9.4): The method of providing financial provision contemplated in Regulation 53.*

The closure cost estimate is undertaken in accordance with the Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine, by the DMR (January, 2005).

10.1 Overview of Legal Requirements

Section 41 and 45 of MPRDA:

- Section 41(1): Requires that an applicant must before the Minister approves the EMP in terms of section 39(4) make the prescribed “financial provision” for the rehabilitation or management of negative environmental impacts.

- Section 41(2): If a holder of a mining right fails to rehabilitate / manage, is unable to undertake such rehabilitation or to manage any negative impact on the environment, the Minister may upon written notice to such holder, use all or part of the financial provision to rehabilitate or manage the negative environmental impact in question.
- Section 41(3): Require the holder to undertake an annual assessment of his or her environmental liability and increase his or her financial provision to the satisfaction of the Minister.
- Section 45: Allows the Minister to recover cost in the event of urgent remedial measures.

Regulation 53 and 54 of the MPRDA Regulation R527:

- Regulation 53 sets out the methods for providing the financial provision required, i.e. trust fund, financial guarantee by a bank or other financial institution, or direct deposit into a bank account stipulated by the DMR Director General;
- Regulation 54: Requires that the quantum of financial provision to be approved by the Minister must be based on the requirements of the approved EMP and shall include detailed itemization of all actual costs required for premature closure regarding:
    - The rehabilitation of the surface of the area;
    - The prevention and management of pollution of the atmosphere;
    - The prevention and management of pollution of water and the soil; and
    - The prevention of leakage of water and minerals between subsurface formations and the surface.
    - Decommissioning and final closure of the operation; and
    - Post closure management or residual latent environmental impacts.

10.2 Closure Goal

The overall closure goal for the proposed Mukulu Mine area is to return the disturbed areas to a state that is as close as possible to the natural conditions. Main Street aims to progressively re-instate an area that is safe, stable, and non-polluting to be integrated into the current land uses (cattle and game farming). The proposed plan to achieve these objectives is provided in the Environmental Rehabilitation Plan, under chapter 11 of this report.

10.3 Summary of Closure Cost

The closure cost methodology and the detailed financial provision is provided in the Closure Cost Assessment report attached under Appendix E.

The costs calculated for the Mukulu Mine, based on the proposed mine plan (Refer to the project description under Chapter 3 and the proposed surface layout under Figure 3.1) are:

Table 10.1 Mukulu Mine Closure Cost Summary

SUB-TOTAL	AMOUNT
Sub-Total 1 [Restoration and Decommissioning Costs]	**R 20 554 778.43 (excl. VAT)**
Sub- Total 2 [Subtotal 1 plus preliminary and general costs and contingency]	**R 25 076 829.69 (excl. VAT)**
Sub- Total 3 [Grand Total]	**R 28 587 585.84 (incl. VAT)**

In accordance with the DMR guidelines, the closure costs (clean closure) include the following:

- Preliminary and General (P&G)
    - 6% if Subtotal 1 is <u>greater than</u> R 100 million; and
    - 12% if Subtotal 1 is <u>less than</u> R 100 million (not applicable).
- 10% Contingency; and
- 14% Vat.

11 ENVIRONMENTAL REHABILITATION PLAN

This chapter fulfills the requirement of Regulation 39 (4) (a) (iii) of the MPRDA Regulations R527 and Chapter 13 of the EMP Template:

- *Section (2- 13): SECTION 39 (4) (a) (iii), Capacity to manage and rehabilitate the environment (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department)*

A rehabilitation plan has been formulated for each the areas which will be disturbed by the proposed surface infrastructure for the proposed Mukulu Mine. The actual cost for rehabilitation action required is also allocated. This rehabilitation plan should thus be read in conjunction with the financial provision (refer to chapter 10 of this report and Appendix E).

11.1 Land Capability and Future Land Use

Land in the project area is mainly used for extensive for cattle, sheep, goat and game farming.

There are limitations to many other land uses, e.g. cultivation due to the dry climatic conditions of the region (high evaporation, due largely to high temperatures, exceed the low rainfall in the region).

The Hotazel area has been identified s a service and mining development node in the John Taolo Gaetswe District Municipality 2010/2011 SDF.

Due to the limitations posed larger by limited availability of water supply, it proposed to return the project area to a condition which is as close to the current condition so that the current land uses may resume after closure of the mine.

11.2 Aim of Rehabilitation Plan

The aim of the rehabilitation plan is to:

- Return the disturbed areas to an acceptable post mining state;
- Ensure all areas are stable, and there is no risk of erosion;
- Ensure that the mining activities are closed to protect the area against subsidence;

- Monitor and manage alien plant invasion on the site until the site is in a stable state; and
- Ensure that all areas are free-draining and non-polluting.

11.3 Rehabilitation Objectives

The overall rehabilitation objectives for the proposed Mukulu Mine are as follows:

- Remove all infrastructure, however where possible and the need is identified infrastructure could be provided as a social investment;
- All demolition waste or hazardous waste will be removed of site to a licensed facility;
- The underground mining accesses and ventilation shaft areas will be made to be safe to ensure no access;
- Visual impacts of rehabilitated areas should be minimised by recreating natural landforms and ensuring that reshaped areas are visually suited to surrounding landscapes;
- Maintaining soil integrity. Soil forms the base from which rehabilitation proceeds. If soils are not correctly prepared, suitable conditions for re-vegetation will not be achieved; and
- Avoid the establishment of alien floral invasion.

11.4 Management Objective for Rehabilitated land

The rehabilitation of all areas disturbed by the Mukulu Mining Project and associated infrastructure must ultimately achieve the objective of returning the land as close to the pre-mining land use as possible.

11.5 Management Criteria for Rehabilitated Land

To meet the management objectives it will be necessary to implement the following management measures, which are applicable to all rehabilitated areas:

- Access to ripped and ameliorated areas will be restricted to avoid compaction and erosion;

- Where self-succession does not succeed, a vegetation programme will be investigated and implemented;
- Traffic onto rehabilitated areas will be limited to allow for the re-establishment of vegetation;
- Alien vegetation establishment will be monitored and controlled, i.e. a weed/alien eradication programme will be implemented to remove undesirable plants;
- Ongoing monitoring for pests and diseases will be undertaken at least once in six months and vegetation will be treated in accordance with identified accepted procedures if necessary;
- Ongoing monitoring of the rehabilitation process will take place to establish if it is necessary to intervene;
- The clean and dirty water systems will be removed as the last phase of rehabilitation;
- No dirty water will be allowed to be discharged into the environment. The land must be rehabilitated until the area can be made free draining, i.e. the runoff from the area must be considered clean;
- Any damage caused by erosion will be rehabilitated and erosion control measures retained and maintained; and
- Annual inspections of rehabilitated areas will be undertaken for the first three years after rehabilitation or until such time that the areas are self-sustaining.

11.5.1 Infrastructure removal and rehabilitation

Rehabilitation of all disturbed land surfaces will include the following and will be completed within a period as specified in the appropriate closure document:

- Photographs of the infrastructure, before, during and after rehabilitation will be taken at selected fixed points and kept on record for the Environmental Coordinator and the DMR purpose;
- All vehicles, conveyors and workshop equipment will be removed for salvage or resale;
- All fixed assets that can be profitably removed will be removed for salvage or resale, however should it be determined that infrastructure has a social or economic benefit for the area, the infrastructure will remain;
- Any item that has no salvage value to the mine but could be of value to individuals will be treated as waste;
- All structures will be demolished, terracing removed and foundations demolished to 400 - 500mm below the original ground level;

- Dismantle and remove redundant fencing for salvage;
- Demolish all concrete fence foundations to 500mm below the original ground level;
- All services like the water supply line and the power line will be demolished only for the section on the mine's property; and
- The contractor laydown area will be demolished and rehabilitated

11.5.2 Rehabilitation for surfaces

Rehabilitation of all disturbed surfaces will include the following and will be completed within a period as specified in the appropriate closure document:

- Where sites have been denuded of vegetation or where soils have been compacted or covered with concretes, these sites will be ripped and ploughed. The topsoil shall be appropriately fertilized to allow vegetation to grow rapidly should self-succession not take place;
- All disturbed and exposed surfaces will be covered with at least 0.15m of topsoil (or as found during ongoing soils monitoring during the life of mine) and re-vegetation must be allowed to take place naturally;
- If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the soil will need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification;
- All rehabilitated areas will be fenced off and access will be controlled;
- Appropriate erosion control measures (i.e. contour banks) must be taken when required; and
- All illegal invader plants and weeds shall be dealt with as required in terms of the relevant legislation.

11.5.3 Disposal of Material

The disposal of material will include the following and will be completed within a period as specified in the appropriate closure document (to be compiled towards the end of the operational phase):

- No building rubble or any other types of waste shall be dumped in the surrounding environment. In cases where it has already happened the sites shall be cleaned up and the waste and/or rubble removed to appropriate sites in consultation with the Environmental Coordinator;
- All types of waste shall be removed entirely from the area and appropriately dealt with in respect of the general waste handling procedure;

- All foreign matter shall be removed from the site;
- Inert ceramics such as bricks, concrete, gravel etc. will be used as backfill or disposed of in a licensed waste disposal site;
- Inert waste, which is more than 500mm underground, such as pipes will be left in place; and
- Inert ceramic and buried waste with a salvage value to individuals such as scrap metal, building materials, etc. will be removed and disposed of at a licensed facility.

11.5.4 Decommissioning of Paste Disposal Facility and Waste Rock Dump

The minimum objectives for the closure and rehabilitation of a dump (PDF and Waste Rock Dump) must be to prevent air and water pollution in accordance with the requirements of the relevant regulations and with good international practice. The intended end use should take into consideration the prior land use and the location with respect to current and potential future socio-economic development.

The objectives of the closure and rehabilitation measures will be:

- To establish a self-sustaining solution with a minimum of on-going maintenance;
- To minimise off-site impacts;
- To create safe and stable landforms;
- To return the site to beneficial land use; and,
- To obtain a closure certificate.

11.5.5 Decommissioning of product stockpile and load out facility area

The objectives of the closure and rehabilitation measures will be:

- To ensure that all stockpiles area removed;
- To remove all concreted areas; and
- To ensure that all compacted soils are ripped and re-vegetated.

11.5.6 Water pollution control structures

The continuous rehabilitation program and the demolishing and/or maintenance of water pollution control structures will attempt to restore the area to an acceptable free draining standard.

- No dirty water will be allowed to be discharged into the environment. The land must be rehabilitated until the area can be made free draining, i.e. the runoff from the area must be considered clean; and
- The clean and dirty water systems will be removed as the last phase of rehabilitation.

11.6 Maintenance

The aim of the maintenance measures are to ensure that the area affected by the mining operations is rehabilitated according to the closure plan and to apply for closure. The objective is for the area to be rehabilitated sustainability, ensuring self-succession of plants and the associated return of natural wildlife; as well as the improvement of the groundwater systems.

The following maintenance measures will be implemented as part of the post-closure process:

- All natural physical, chemical and biological processes for which a closure condition has been specified must be monitored for three (3) years after closure or as long as deemed necessary at the time. Such processes include erosion of the rehabilitated surfaces, surface water drainage, surface water quality, groundwater quality, vegetative re-growth, weed encroachment and colonization by animals;
- Measures must be implemented to curb environmental impacts and to ensure that they do not worsen/cumulate over time;
- The closure plan will be reviewed every five (5) years; and
- All rehabilitated areas will be monitored and maintained until such time as required to enable the mine to apply for closure of these different areas.

The following activities will be included during the maintenance phase:

- The closure costs (demolition, removal, re-shaping and rehabilitation quotes per key quantity) for each facility must be included in the database so that the total closure cost can be determined;

- All facilities that become redundant during the LOM must be rehabilitated concurrently to lighten the rehabilitation process at the end of the mine's life;
- Attention must be paid to the latest developments in mine rehabilitation sciences;
- Rehabilitation should be done as soon as possible, to ensure that the rehabilitation work required is kept to a minimum at the end of the life of the mine;
- Ensure that the area is free draining;
- Ensure that self-succession has been implemented;
- Ensure that all slopes are safe in the long term;
- Submission of closure report and application for closure to the authorities; and
- Environmental monitoring and maintenance for three years after closure.

11.7 Submission of Information

- All procedures (emergency, environmental awareness, rehabilitation strategies, etc.) must be included into the mine's Environmental Management System (EMS). The mine's EMS will monitor and assess the performance of the EMP on an ongoing basis. Formal audit of the performance assessment of the EMP will take place at the frequency required by the DMR in the approved EMP;
- All information as required by the various government departments should be captured and be readily available for submission when required;
- An annual report will be submitted to the DMR;
- Groundwater monitoring will be undertaken on a quarterly basis by independent specialists. Annual groundwater reports will be submitted to the DWA;
- The Groundwater Levels will be monitored on a quarterly basis and will be presented in the form of piezometric maps, from which changes can be determined through time. Annual groundwater reports will be submitted to the DWA;
- The monitoring of dirty water dams will be undertaken on a monthly basis and reports produced on a quarterly basis for submission to DWA together with the groundwater reports;
- An Environmental Management Programme Performance Assessment will be undertaken every two years as required by the MPRDA and will be submitted to the DMR;

- The financial provision for closure (quantum and method) will be updated every two years as part of the Environmental Programme Performance Assessment; and
- The Closure Plan must be reviewed every five (5) years, and must always keep pace with the current best practices.

11.8 Rehabilitation – Phase 1

This phase will involve, demolition work, blasting, loading and disposing of rubble material, selling of salvage, as well as the negation of the need of infrastructure for social investments. During this phase the following activities will be carried out (Refer to Figure 11.1):

- Erection of fencing around all areas where demolition is taking place;
- Removal of all mining infrastructure, including shafts and the capping of these accesses to ensure safety;
- Removal of plant and plant infrastructure including all buildings;
- Removal of buildings including workshops and offices;
- Dismantling overland conveyors (between main shafts on Mukulu, Olive Wood and Belgravia);
- Dismantling railway loop and siding;
- Removal of concreted load bay area;
- Removal of powerlines; and
- Removal of water supply lines.

Due to the fact there is not sufficient detail in the mine plan to indicate where the shaft infrastructure will be located; the proposed shafts on Olivewood and Belgravia are not indicated on the rehabilitation maps.

11.9 Rehabilitation – Phase 2

The purpose of this phase is to shape the areas to form a free-draining landscape which flows into the surrounding environment, loosen the compacted areas to assist in vegetation establishment. During this phase, the following activities will be undertaken (Refer to Figure 11.2):

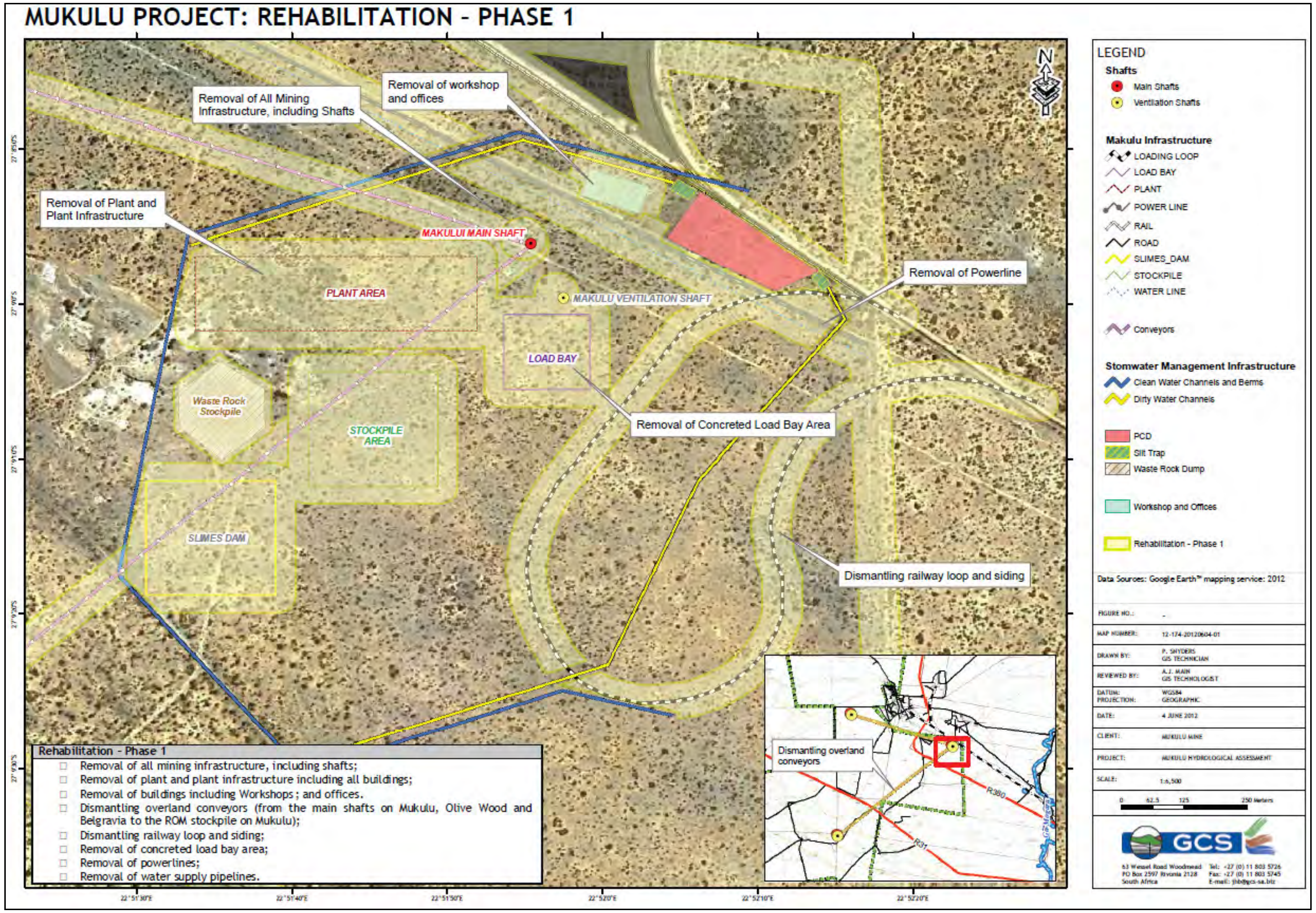
- Ripping of soils;

- Amelioration of dumps;
- Removal of dirty water infrastructure (PCD's and RWD);
- Ensure that the slope of the remaining dumps (i.e. Waste Rock Dumps, Paste Disposal Facility) is to such a degree to allow self-succession and no erosion;
- Topsoil placement (where required) and re-vegetating (where required) disturbed areas; and
- Rehabilitation of berms, channels and PCDs to make the area free draining.

11.10 Rehabilitation - Phase 3

Phase 3 will involve the following activities (Refer to Figure 11.3):

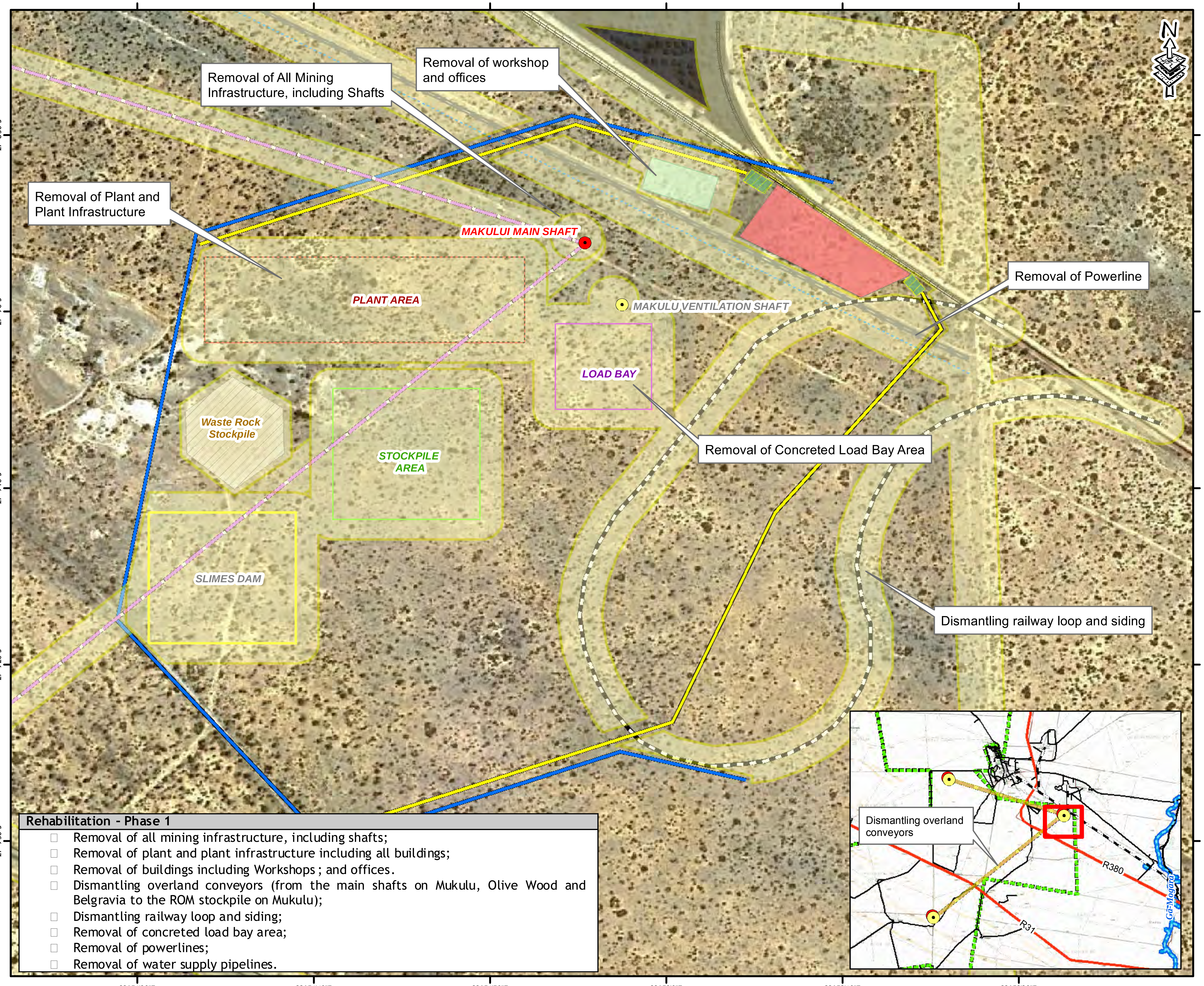
- Removal of fencing; and
- Aftercare monitoring:
  - Groundwater monitoring;
  - Vegetation monitoring;
  - Weed Eradication on monitoring of progress;
  - Soils monitoring; and
  - Social Plan monitoring (skills development and retrenchments).



[Figure not to scale- refer to A3 figure attached]

Figure 11.1 Mukulu Mine rehabilitation: Phase 1

MUKULU PROJECT: REHABILITATION - PHASE 1



Rehabilitation - Phase 1

- Removal of all mining infrastructure, including shafts;
- Removal of plant and plant infrastructure including all buildings;
- Removal of buildings including Workshops; and offices.
- Dismantling overland conveyors (from the main shafts on Mukulu, Olive Wood and Belgravia to the ROM stockpile on Mukulu);
- Dismantling railway loop and siding;
- Removal of concreted load bay area;
- Removal of powerlines;
- Removal of water supply pipelines.

LEGEND

Shafts
- Main Shafts
- Ventilation Shafts

Makulu Infrastructure
- LOADING LOOP
- LOAD BAY
- PLANT
- POWER LINE
- RAIL
- ROAD
- SLIMES_DAM
- STOCKPILE
- WATER LINE
- Conveyors

Stomwater Management Infrastructure
- Clean Water Channels and Berms
- Dirty Water Channels
- PCD
- Silt Trap
- Waste Rock Dump
- Workshop and Offices
- Rehabilitation - Phase 1

Data Sources: Google Earth™ mapping service: 2012

FIGURE NO.:	-
MAP NUMBER:	12-174-20120604-01
DRAWN BY:	P. SNYDERS GIS TECHNICIAN
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	4 JUNE 2012
CLIENT:	MUKULU MINE
PROJECT:	MUKULU HYDROLOGICAL ASSESSMENT
SCALE:	1:6,500

0 62.5 125 250 Meters

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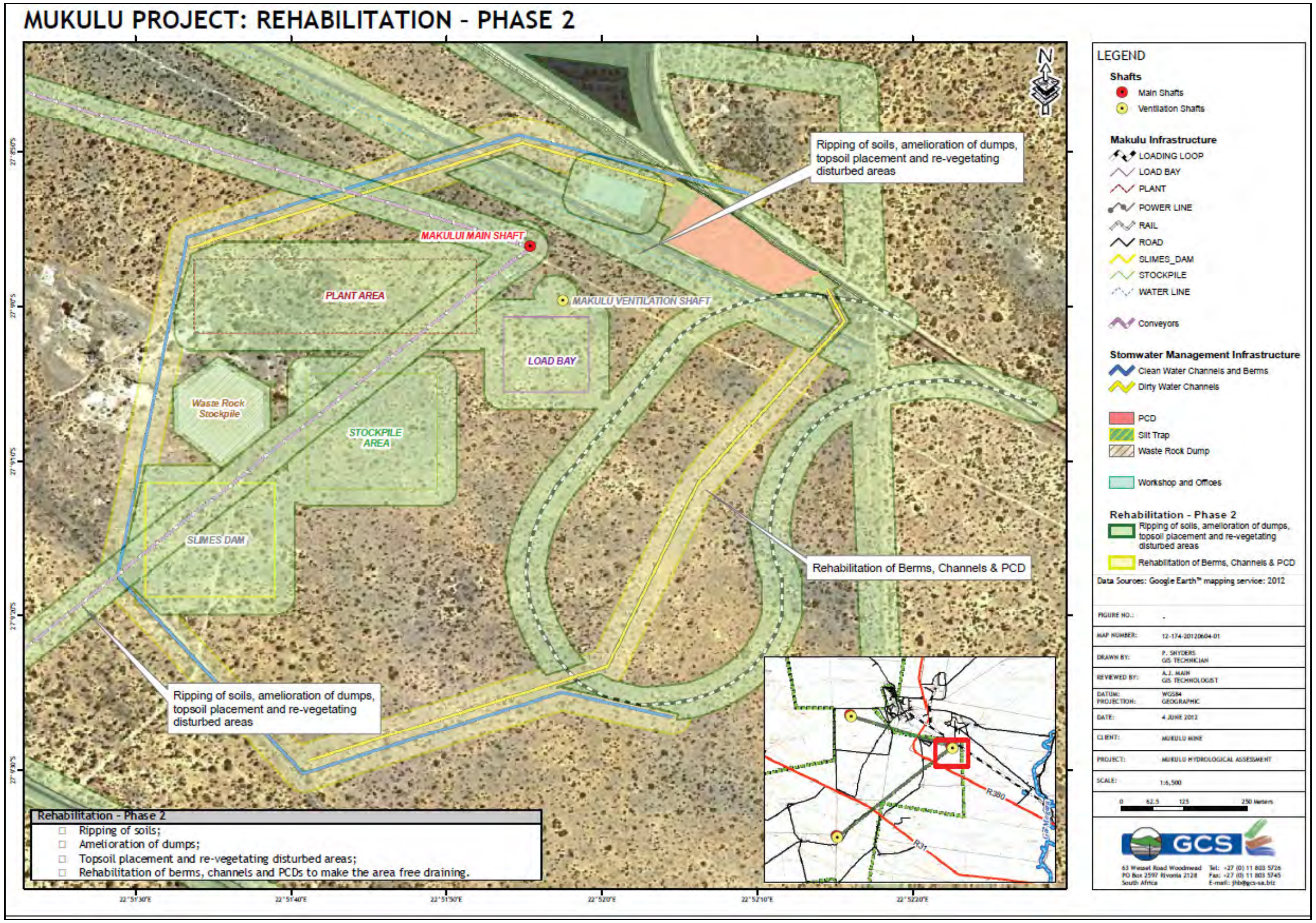
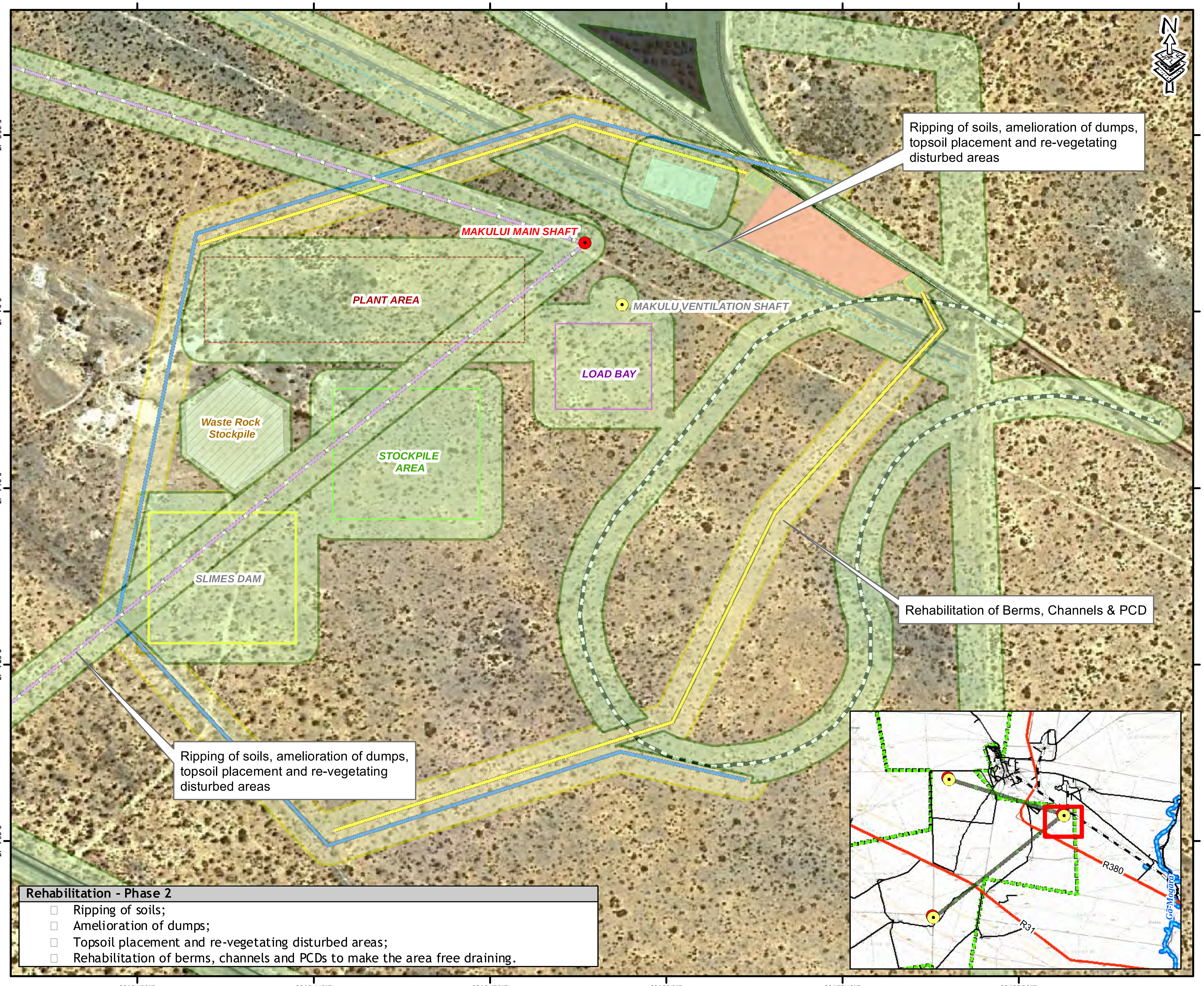


[Figure not to scale- refer to A3 figure attached]

Figure 11.2 Mukulu Mine rehabilitation: Phase 2

MUKULU PROJECT: REHABILITATION - PHASE 2



Rehabilitation - Phase 2

- Ripping of soils;
- Amelioration of dumps;
- Topsoil placement and re-vegetating disturbed areas;
- Rehabilitation of berms, channels and PCDs to make the area free draining.

LEGEND

Shafts

- Main Shafts
- Ventilation Shafts

Makulu Infrastructure

- LOADING LOOP
- LOAD BAY
- PLANT
- POWER LINE
- RAIL
- ROAD
- SLIMES_DAM
- STOCKPILE
- WATER LINE
- Conveyors

Stomwater Management Infrastructure

- Clean Water Channels and Berms
- Dirty Water Channels
- PCD
- Silt Trap
- Waste Rock Dump
- Workshop and Offices

Rehabilitation - Phase 2

- Ripping of soils, amelioration of dumps, topsoil placement and re-vegetating disturbed areas
- Rehabilitation of Berms, Channels & PCD

Data Sources: Google Earth™ mapping service: 2012

FIGURE NO.:	-
MAP NUMBER:	12-174-20120604-01
DRAWN BY:	P. SNYDERS GIS TECHNICIAN
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	4 JUNE 2012
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SCALE:	1:6,500

0 62.5 125 250 Meters

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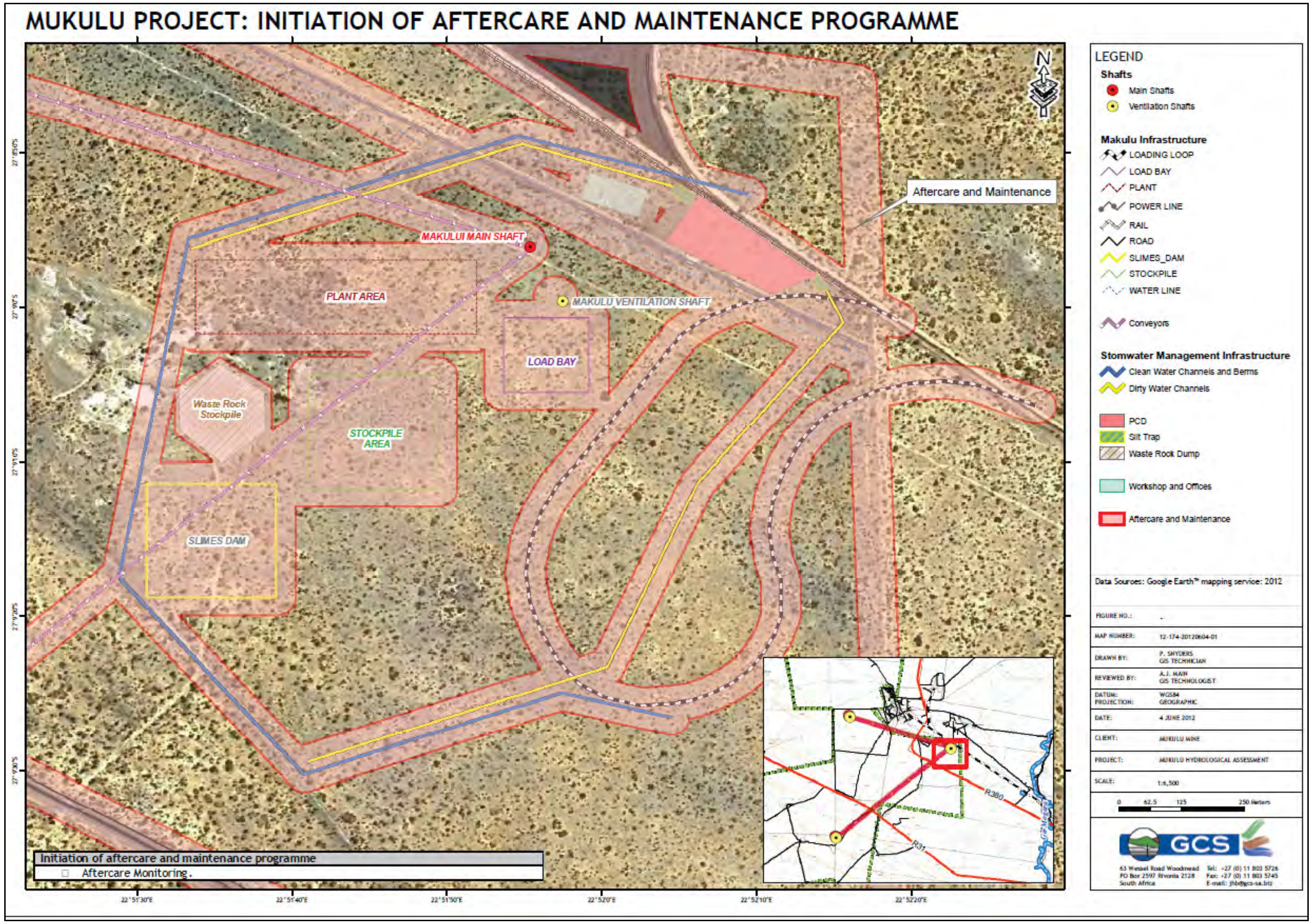
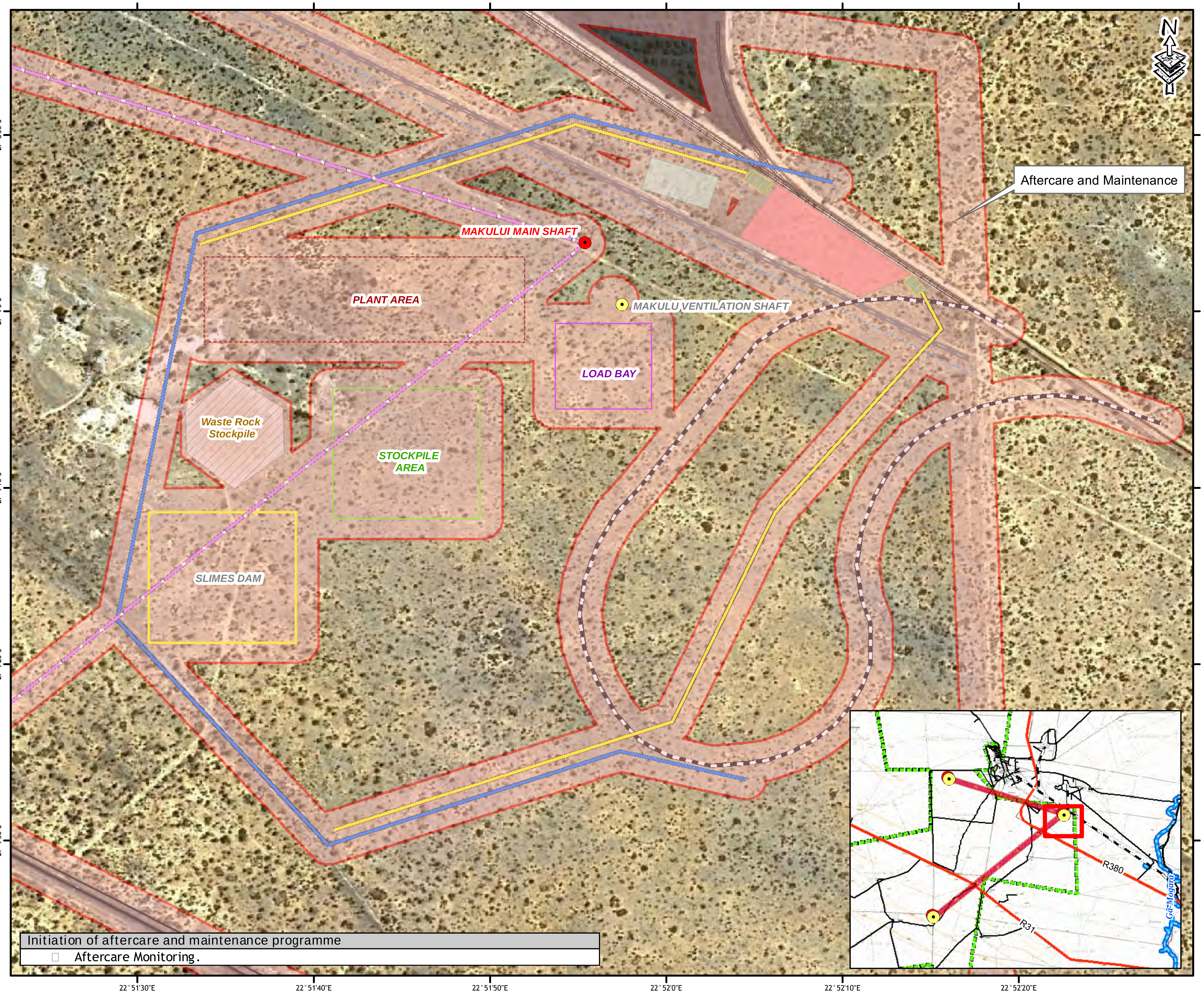


[Figure not to scale- refer to A3 figure attached]

Figure 11.3 Mukulu Mine rehabilitation: Phase 3

MUKULU PROJECT: INITIATION OF AFTERCARE AND MAINTENANCE PROGRAMME



LEGEND

Shafts

- Main Shafts
- Ventilation Shafts

Makulu Infrastructure

- LOADING LOOP
- LOAD BAY
- PLANT
- POWER LINE
- RAIL
- ROAD
- SLIMES_DAM
- STOCKPILE
- WATER LINE

- Conveyors

Stomwater Management Infrastructure

- Clean Water Channels and Berms
- Dirty Water Channels

- PCD
- Silt Trap
- Waste Rock Dump

- Workshop and Offices

- Aftercare and Maintenance

Data Sources: Google Earth™ mapping service: 2012

FIGURE NO.:	-
MAP NUMBER:	12-174-20120604-01
DRAWN BY:	P. SNYDERS GIS TECHNICIAN
REVIEWED BY:	A.J. MAIN GIS TECHNOLOGIST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC
DATE:	4 JUNE 2012
CLIENT:	MUKULU MINE
PROJECT:	MUKULU HYDROLOGICAL ASSESSMENT
SCALE:	1:6,500

0 62.5 125 250 Meters

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11.11 Rehabilitation responsibilities

The responsibilities of various parties during the rehabilitation phase are presented in Table 11.1.

Table 11.1 Responsibilities and Responsible Parties for Rehabilitation Activities

RESPONSIBLE PARTY	RESPONSIBILITIES
Environmental Manager of Mukulu Mine	- Planning of rehabilitation project; - Initiating rehabilitation projects; and - Compilation of closure plan with regards to rehabilitation area/sites.
Environmental Manager of Mukulu Mine	- General monitoring/surveillance and reporting and coordination; and - Implementation/coordination with regard to particular environmental measures/action plans.
Environmental Coordinator of Mukulu Mine	Audits (Environmental, EMP Performance Assessment, etc.) and surveillance.
General Manager of Mukulu Mine	Authorisation of all rehabilitation projects.

12 INFORMATION GAPS AND RECOMMENDATIONS

REGULATION 50 (g):

- *(Section 14): The appropriate mitigatory measures for each significant impact of the proposed mining operation.*
    - *(Section 14.1): Adequacy of predictive methods utilized:*
    - *(Section 14.2): Adequacy of underlying assumptions:*
    - *(Section 14.3): Uncertainties in the information provided.*

12.1 Adequacy of predictive methods utilized

12.1.1 Groundwater assessment

The groundwater impact assessment, which includes the calculated dewatering volumes and the projected nitrate pollution plumes (after 20 years of mining) were based only on the proposed mining on the farm Mukulu 265, as the proposed underground mine plan for the orebodies to be exploited via the shafts on Belgravia and Olivewood have not yet been developed. These will be developed at a later stage.

Once these are available, the groundwater model must be updated to determine the impacts which will be created when these shafts are phased in.

12.2 Uncertainties

12.2.1 Waste Management License

The sewage package plant which will be required for the proposed mine will require a waste management license (WML) in terms of the NEM: WA.

The applicant will appoint an independent environmental assessment practitioner to undertake the application of this application as soon as more details regarding package plant is available.

12.2.2 Geotechnical Investigation

Subsidence was identified as a potential risk during the environmental impact assessment process due to the proposed location of the surface infrastructure on the farm Mukulu 265 above the underground mine. The risk must be investigated and quantified and recommendations thereto made by means of a Geotechnical Investigation.

It is recommended that Main Street appoint a qualified independent expert to undertake the required Geotechnical Investigation.

12.2.3 Soil, and use and land capability

A detailed mine plan has not yet been developed (the mine plan as presented in Figure 3.1 was used by the environmental specialists to undertake their environmental impact assessments), therefore the calculations of the soil stripping volumes estimated ,might be somewhat different to those for the project based on the exact footprint of the operations.

To determine impacts on soil, land use and land capability the general procedures associated with underground manganese mining and the construction of surface infrastructure was assumed.

12.2.4 Wetland and Aquatic 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.

Difficulties were initially experienced in accessing certain portions of the study area. The site during field work as there was initial difficulty with landowner consultation (prior to the landowner consultation meeting on 19 May 2012). While most of the site was accessed eventually, the game camp on Assmang Property (farm Belgravia 264) could not be accessed and was not surveyed in the field. However, it is considered highly unlikely that any wetlands occur on this property.

Very limited information was available regarding mine planning for the Belgravia and Olivewood ore bodies. The only planned infrastructure on the mine place is the proposed twin vertical shafts on each property.

All the small pans identified on site were dry at the time of the field work and no water or diatom samples could be collected.

12.2.5 Surface water assessment

Insufficient topographical and mining information was available to enable the placement of drains within the dirty water area and provisional design of oil and silt traps and other infrastructure that is likely to be required to ensure adequate control of polluted runoff.

The demand for potable water in offices, workshops, change-rooms, etc. or plans for the disposal of sewage and other waste generated in these areas have not been determined yet. Domestic demands and treated effluent from waste water treatment processes were therefore excluded from both the conceptual water balance and conceptual SWMP.

The storm water management plan should be updated and a detailed water balance should be compiled once these details are available.
The proposed shaft on Belgravia appears to be adjacent to a local calcrete pan, where it would appear that water is pumped into this less permeable depression to provide drinking water for stock and game. It may be necessary to move the proposed shafts, or provide an alternative watering hole site before the shaft is constructed.

At this early stage, the exact volumes of water that will be available for dewatering are not known, many of the production figures are inferred from excavation drilling at a lower level of confidence and the efficacy of mining procedures still need to be tested.

12.2.6 Terrestrial Biodiversity

Access

Access to all portions of the development areas was inadequate. Surveys were conducted only on one of the three sections (proposed mining areas) and results were therefore extrapolated based on visual observations and aerial imagery of the study areas.

Seasonal constraints

The survey was ultimately conducted during an early winter period (May) and results clearly indicate the vegetative state of most of the vegetation, the absence of any reproductive material that is needed for the identification of forbs and geophytes in particular. In terms of the faunal component, the absence of numerous migratory birds and invertebrates that are known to inhabit these areas indicate a winter period.

Protected species

No information pertaining to the distribution and abundance of protected trees and other plant species were collated during this assessment; this usually forms the basis of a separate investigation. Information needed for the completion and submission of applications to the Department of Agriculture, Forestry and Fisheries (DAFF) and NCDENC should therefore be compiled during a separate investigation.

Recommendations

In order to adequately address these limitations, the following recommendations are proposed:

- Suitable surveys should be conducted during the austral summer period subsequent to adequate rain. In order to schedule these surveys, it will be necessary to communicate on a frequent basis with landowners living on the relevant farms, keeping informed exactly when rain has been received. Information indicates that rain can be expected from November onwards; it is more likely to rain during December and January;
- All areas need to be included; access with all relevant landowners will be arranged prior to the site investigation;
- The opportunity will also be used to investigate the abundance and distribution of protected trees and other plant species; this information will be presented to the client for the completion and submission of the relevant application forms to DAFF and NCDENC;
- Surveys should include a re-assessment of sites surveyed during this assessment in order to limit seasonal bias during data analysis; and
- Subsequent to the site investigation, all collated data will be subjected to an analysis programme and the Terrestrial Biodiversity report will be updated to reflect the additional data.

12.2.7 Heritage assessment

Due to the limited access to Portion 0 of the farm Santoy 230, it is possible that all cultural sites may not have been identified. This property however, is a considerable distance away from the proposed shaft on Belgravia 284, which is the closest proposed mining infrastructure to this property.

12.3 Underlying Assumptions

12.3.1 Rezoning Application

During April 2012, the South African Constitutional Court ruled that any land for which mining is planned must first be rezoned in accordance with the relevant municipal and provincial land use planning ordinances.

Main Street commits to obtaining any all necessary rezoning classifications prior to the commencement of the construction phase of the proposed mine.

12.3.2 Water Supply

Due to the arid nature of the region, water supply is a major issue, and not securing a reliable supply represents a fatal flaw.

The applicant intends to obtain all potable water from the Vaal Gamagara Scheme. It is recommended that negotiations are finalized and an agreement reached prior to the construction phase beginning.

12.3.3 Power supply

Power supply is also a factor which must be finalized before construction may begin. It is recommended that an application is lodged and follow up undertaken with Eskom to ensure that they make provision in their planning for the proposed Mukulu Mine.

12.3.4 Transport

Main Street intends to utilize the rail system from Hotazel to transport manganese ore to the Port of Ngqura. The significance of the proposed Mukulu Mine's impact on the traffic and roads in the area is therefore considered to be low.

Should road transport be considered at any stage, it is recommended that a traffic impact assessment is undertaken to determine the potential impacts and that the local residents and landowners are consulted with to receive their input (comments, objections or suggestions) before this option is implemented.

12.4 Public Participation Process

The public participation undertaken has complied with the MPRDA Regulations. However, due to the limited period allocated for the assessment of the biophysical, socio-economic and heritage environment and the submission of the EIA/EMP report, there was insufficient time to make a draft version of this document available to I&APs for review and comment prior to submitting the report to the authorities.

This report will be submitted to the registered stakeholders at the same time as submission to the authorities.

13 CONCLUSION

Main Street submitted a Mining Right Application in November 2011 with the Department of Mineral Resources (DMR) with respect to the Mukulu Mine area in the vicinity of Hotazel in the Northern Cape Province. Four (4) of the properties are owned by Assmang, including Mukulu 265 where a shaft and surface infrastructure are proposed and Belgravia 264 on which a shaft is proposed. The remaining five properties are owned by private persons. One of these properties, Olivewood 284 is the proposed location for one of the shafts, which will be phased in later on during the LoM.

It is planned that construction activities will commence during 2014 in order to commence with underground mining activities at the Mukulu shaft from 2016 to 2045. The Olivewood shaft is planned to came into effect from 2025 t0 2045 and the Belgravia shaft from 2038 to 2045. This provides for a life of mine of 29 years with an additional two year of construction.

Full production of 1 million tons per annum (high grade manganese) will be attained early in the second year of production (2018) and will be maintained until 2025. Once the Olivewood shaft is phased in, the production will increase to 2 million tonnes per annum, then to 2.5 million tonnes per annum once the Belgravia shaft is phased in.

The current land use within the project area is dominated by cattle grazing and game farming.

Although there were initially issues with landowners regarding access to some of the properties, these were resolved during a landowner consultation meeting held in Hotazel on 10 May 2012.

Following the landowner consultation, public advertising and the specialist investigations, the following issues were identified:

- Groundwater impacts: Landowners highlighted this as major concern, as this will impact on the current land use. The groundwater model, based on the proposed mining at Mukulu 265, indicated that the drawdown cone to be created after 20 years of mining will not impact on any private groundwater users, however the study only involved one of the three proposed underground mining areas as the underground mine plans for the Olivewood and Belgravia areas was not available when the study was undertaken;

- Water supply: Securing a reliable source of water is critical for the proposed development in such an arid region. It is recommended that an agreement is reached with Sedibeng Water regarding obtaining water supply from the Vaal Gamagara Scheme prior construction;
- Power supply: Eskom has requested that an application is lodged as soon as possible to enable the future planning for this area; and
- Rail transport of ore: Main Street has begun negotiations with Transnet regarding the use of the railway line from Hotazel to the manganese port which is due to be moved from Port Elizabeth to Ngqura.

The following recommendations are made:

- Undertake a detailed mining plan for the proposed underground operations;
- Conduct Geotechnical Investigation to determine the risk of subsidence on the farm Mukulu 265 during mining operations;
- Conduct a summer (December/January) Terrestrial Biodiversity survey within the project are to augment the results of the current results;
- Undertake an EIA to apply for a Waste Management License for the required sewage treatment plant; and
- Apply for any required rezoning of the proposed MRA area.

14 LIST OF SPECIALIST REPORTS

This chapter provides a list of the specialist reports which are appended to this EIA/EMP as required by section 2 – 11 and 2 – 16 of the DMR EIA/EMP Template:

- *Section 2 -11): Attachment of specialist reports, technical and supporting information. (Provide a List)*

REGULATION 50 (i):

- *(Section 2 – 16): Technical and supporting information. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)*

The following Specialist studies were undertaken during April and Amy 2012 and the reports attached as appendices to this EIA/EMP report:

- Hydrogeological (groundwater) Assessment- (GCS)- Appendix B-1;
- Hydrological (surface water) Impact Assessment- (GCS) – Appendix B-2;
- Terrestrial Biodiversity (fauna and flora) Assessment- (Bathusi Environmental Consulting)- Appendix B-3;
- Wetland and Riparian Areas Delineation and Assessment- (Wetland Consulting Services)- Appendix B-4;
- Soils, Land Use and Land Capability- (TerraAfrica Consult)- Appendix B-5;
- Heritage Impact Assessment – (Archaetnos Culture and Cultural Resource Consultants)- Appendix B-7; and
- Social Impact Assessment – (GCS) – Appendix B-8.

15 UNDERTAKING

This chapter of the report complies with Section 13 of the EMP Template:

- *(Section 1 - 13.1): The Environmental Management Programme will, should it comply with the provisions of section 39 (4) (a) of the Act and the right be granted, be approved and become an obligation in terms of the right issued. As part of the proposed Environmental Management Programme, the applicant is required to provide an undertaking that it will be executed as approved and that the provisions of the Act and regulations thereto will be complied with.*

The signed undertaking is provided on the next page.

UNDERTAKING

(to be completed upon the final submission)

I, ____. , the undersigned and duly authorised thereto by Main Street 778 (Pty) Ltd, have studied and understand the contents of this Environmental Management Programme (EMP) and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to.

Signed at ____, on this ___________, day of

_________________ 2012.

.___________________________.
Signature of Applicant

I, ____, the undersigned and duly authorised thereto by the DEPARTMENT OF MINERAL RESOURCES, have studied and approved the contents of this Environmental Management Programme (EMP).

Signed at ____, on this ___________, day of

_________________ 2012.

.___________________________.
Signature of Director

16 REFERENCES

Archaetnos Culture & Cultural Resource Consultants. April 2012. A Report on a Heritage Impact Assessment for the proposed Main Street 778 (Pty) Ltd Mining Right Application close to Hotazel, Northern Cape Province.

Bathusi Enviromental Consulting. May 2012. Terrestrial Biodiversity Impact Assessment for the Proposed Mukulu Manganese Mine Project, Hotazel. Northern Cape Province.

Brian Hayward, P.E Herald. 17 February 2012 “Transnet to spend R9bn on upgrade of Bay Harbours.

Department of Cooperative Governance and Traditional Affairs. John Taolo Gaetswe District Municipality Profile (no date given on report).

GCS (Pty) Ltd. May 2012. Main Street 778 (Pty) Ltd Social Impact Assessment Report.

GCS (Pty) Ltd. May 2012. Mukulu Project Hydrogeological Investigation.

GCS (Pty) Ltd. May 2012. Mukulu Project Surface Water Specialist Study.

GCS (Pty) Ltd. May 2012. Soil, Land Use and Land Capability Study for the Proposed Mukulu Project.

Ivuzi Environmental Consultants. May 2009. Assmang Limited Black Rock Manganese Mines Environmental Impact Assessment and Management Programme Alignment Report.

John Taolo Gaetsewe District Municipality. 2011. John Taolo Gaetsewe District Municipality Reviewed Integrated Development Plan, 2010/11.

John Taolo Gaetsewe District Municipality. 2012. John Taolo Gaetsewe District Municipality Saptial Development Framework, 2012.

Wetland Consulting Services. May 2012. Wetland Delineation and Assessment for the Proposed Main Street 778 (Pty) Ltd Manganese Mine near Hotazel in the Northern Cape.

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