REPORT

Mamatwan Manganese (Pty) Ltd

Environmental Impact Assessment and EMPr

NC 30/1/2/2/10031 MR

Portions 3, 8 and 18, as well as the remainder of the Farm Mamatwan No 331

Prepared for:

Mamatwan Manganese (Pty) Ltd
Postnet Suite X 11, Birnam, Johannesburg

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Environmental Impact Assessment and Environmental Management Programme (EMPr)

Mamatwan Manganese (Pty) Ltd EIA and EMPr

NC 30/1/2/2/10031 MR

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Signature:			
Date:	2014/02/24	2014/03/05	2014/03/05

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ABBREVIATIONS

AIA - Archaeological Impact Assessment

BID - Background Information Document

DEA - Department of Environmental Affairs

DEAT - Department of Environmental Affairs and Tourism (currently known as DEA)

DENC – Northern Cape Department of Environment and Nature Conservation

DWA - Department of Water Affairs

EIA - Environmental Impact Assessment

EIR - Environmental Impact Report

EMPR - Environmental Management Programme

ENPAT - Environmental Potential Atlas

FGM - Focus Group Meeting

GDP - Gross Domestic Product

GGP - Gross Geographic Product

GIS - Geographic Information System

HIA - Heritage Impact Assessment

I&APs - Interested and Affected Parties

IDP - Integrated Development Plan

IPAP - Industrial Policy Action Plan

NEMA - National Environmental Management Act, 1998 (Act No. 107 of 1998)

NEMBA - National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

NFEPA - The National Freshwater Ecosystem Priority Area

NHRA - National Heritage Resources Act, 1999 (Act No. 25 of 1999)

NWA - National Water Act, 1998 (Act No. 36 of 1998)

PPP - Public Participation Process

SAHRA - South African Heritage Resources Agency

SANBI - South African National Biodiversity Institute

VAC - Visual Absorption Capacity

DEFINITIONS

Alien species: A plant or animal species introduced from elsewhere: neither endemic nor indigenous.

Anthropogenic: Change induced by human intervention.

Applicant: Any person who applies for an authorisation to undertake an activity or undertake an Environmental Process in terms of the Environmental Impact Assessment Regulations – National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as contemplated in the scheduled activities listed in Government Notice (GN) No R. 543, 544 and 545.

Arable potential: Land with soil, slope and climate components where the production of cultivated crops is economical and practical.

Archaeological resources: This includes:

1. Material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
2. Rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation; and
3. Wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cultural significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Cumulative Impact: In relation to an activity, cumulative impact means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Ecology: The study of the interrelationships between organisms and their environments.

Environment: All physical, chemical and biological factors and conditions that influence an object.

Environmental Impact Assessment: In relation to an application, to which Scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application.

Environmental Impact Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

Ephemeral: When referring to a stream or drainage line, it refers to the flow characteristics by which only periodic surface flows typically occur. Similarly when referring to a pan or depression, this would be characterised by only periods of time when surface water occurs within it, usually associated with the rainy season.

Episodic watercourse: No flow of water at least 76% of the time during the rainfall season or out of season and flows briefly only after a flood.

Heritage resources: This means any place or object of cultural significance. See also archaeological resources above.

Hydromorphic / hydric soil: Soil that in its un-drained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring growth and regeneration of hydrophytic vegetation. These soils are found in and associated with wetlands.

Local relief: The difference between the highest and lowest points in a landscape. For this study, it is based on 1:50 000 scale.

Macro-geomorphological: Related to / on the scale of geomorphic provinces. A geomorphic province is a spatial entity with common geomorphic attributes.

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Red Data species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

Scoping Report: An “issues-based” report which forms the first phase of an Environmental Impact Assessment process.

Soil compaction: Soil becoming dense by blows, vehicle passage or other type of loading. Wet soils compact easier than moist or dry soils.

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED MANGANESE MINE FOR MAMATWAN MANGANESE (PTY) LTD

KEY PROJECT INFORMATION

Reference number:	NC 30/1/2/2/10031 MR
Title:	Environmental Impact Assessment and Environmental Management Programme for the proposed manganese mine for Mamatwan Manganese (Pty) Ltd
Authors:	Monica Niehof
Client:	Mamatwan Manganese (Pty) Ltd
Farm Description:	Portions 3, 8 and 18, as well as the remainder of the Farm Mamatwan No 331
21 Digit Surveyor General Code:	C04100000000033100003; C04100000000033100000; C04100000000033100008; and C041000000000331018

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DETAILS OF ENVIRONMENTAL ASSESSMENT TEAM

B.1 Environmental consulting team

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B.2 Project team

Emile van Druten:

Emile started Environmental Assurance (Pty) Ltd in 2004 after having spent 12 years as an Environmental manager at various corporate institutions. His career started in the conservation field as an anti-poaching team member at the Kwa Zulu Natal Parks Board.

He then joined the mining industry where he served companies such as Kudu Granite, Anglo American and BHP (Ingwe mining); his most recent corporate move was to Telkom South Africa where he headed up the Environmental and Health department.

Emile holds a BSc Hon degree from the University of Potchefstroom (University of the North West); he complimented this with an Environmental training diploma from the University of Rhodes and a Masters Degree in Project Management from the University of Pretoria [Management School].

He is a qualified ISO 14001 auditor having been appointed through an European based certification authority (TGA Germany). Emile is blessed with a family and his main hobby is art-lure fishing for which he has recently obtained provincial colours.

Judith Mlanda-Zvikaramba

Judith is a seasoned sustainable development practitioner with a special interest in environmental and social sustainability. She holds a Masters degree in Environment and Society from the University of Pretoria's Centre for Environmental Studies as well as a Bachelor of Arts degree in Sociology and Psychology obtained from the University of Namibia. She has over 9 years of experience and is EAPSA certified.

Judith has worked in the consulting industry on public and private sector projects. She has extensive experience and knowledge including but not limited to environmental and social impact assessments integrated water and waste management, environmental auditing and monitoring, carbon management and climate change.

Monica Niehof

Monica has seven years' experience in the environmental field and 13 years work experience overall in a variety of fields including the tourism industry. She is currently studying towards a BSc. (Hons) degree in Environmental Management.

Her experience in the environmental field include Environmental Impact Assessments (EIA's), Environmental Management Programmes (EMP's), Public Participation Processes (PPP's) and Environmental Control and Monitoring for a variety of development projects including residential, retail, commercial and infrastructure projects.

NAME OF APPLICANT: Mamatwan Manganese (Pty) Ltd

REFERENCE NUMBER: NC 30/1/2/2/10031 MR

ENVIRONMENTAL IMPACT ASSESSMENT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME

SUBMITTED FOR AN APPLICATION FOR A MINING RIGHT

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 Act)

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

STANDARD DIRECTIVE

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.

SECTION 1 ENVIRONMENTAL IMPACT ASSESSMENT

REGULATION 50 (a)

1. Description of the baseline environment

1.1 Concise description of the environment on site relative to the environment in the surrounding area

SOILS AND GEOLOGY

The investigated area falls within the 2722 Kuruman 1:250 000 geology series map.

The study area is underlain by the south-western part of the Kalahari Manganese Fields (KMF), which in turn lies within a large structural basin that extends approximately 40 km south to north and 5 km to 15 km east to west, dipping gently north-west. The manganese deposits are in the Hotazel Formation at the top of the Transvaal Supergroup. The high level of lateral continuity and relative geological simplicity render it an important manganese resource on a global scale.

The stratigraphy (*refer to Figure 1 below*) of the ore-bearing succession in the area consists of three superimposed manganese beds named the Upper (UMO), Middel (MMO) and Lower Manganese (LMO) Ore bodies. The LMO is the main source of ore associated with the KMF and varies in thickness from 2 m to 45 m, although only portions of the package are mineralised to economic concentrations. The Middle Manganese Ore body is generally uneconomic and only 1 to 2 m thick. The Upper Manganese Ore body is up to 5 m thick and only mined locally. The LMO has been subdivided (Nel 1984) on the basis of mineralogical composition which is often manifested by visual mineralogical differences (*refer to Figure 2 below*).

The mineralised bodies are hosted by altered banded iron-formation (BIF) and jaspilites of the Hotazel Formation, which unconformably overlies the Ongeluk Lava. The deposits are overlain by younger, mainly dolomitic and chert-bearing lithologies of the Olifantshoek Group, which are in turn overlain by the Karoo-age Dwyka Group, represented by a succession of glacial diamictites deposited on an uneven paleosurface. The Kalahari Formation consisting of a sequence of flat-lying unconsolidated sediments with a maximum thickness of approximately 125 m, cover the entire sequence to approximately 70 m below surface. Aeolian sand, limestone and red clay are the typical sediments encountered (Mucina, 2006). Also refer to Figure 3 below.

The area is characterised by Kalahari Bushveld, parallel red sand dunes, dry Savanna, sandy soils and a lack of water resources. The region forms the southern rim of the Great Kalahari Desert. The surface is characterised by Kalahari sands (to the depth of approximately 70 m) and calcrete outcrops. The water table is situated within the Kalahari sand layer beneath which there are rock pebbles and clay layer before intersecting the Dwyka. The topography of the area consists of the flat sand plains between the Korannaberg Mountains and Kuruman River. It

is characterised by two sand dunes with one situated on the southeast corner of the farm and another situated along the banks of the episodic Vlermuisleegte Watercourse, a tributary of the Kuruman River.

The region soil is red sand which is freely drained due to its weak structure and limited amount of clay in the soil. The majority of the site is located within land type Af 28 with dunes composed of the soil forms Gaudam (Hu31) and Roodepoort (Hu30). The soil forms (Hu31 and Hu30) are fine to medium textured with low clay content of 1-2% and have a low fertility making them prone to drainage. Due to the poor soil type typical agricultural practices on the site and the neighbouring areas are limited to livestock farming and game ranching. The key elements are the target manganese reefs situated beneath the Dwyka. The surface is characterised by Kalahari sands (to the depth of approximately 70 m) and calcrete outcrops. The water table is situated within the Kalahari sand layer beneath which there are rock pebbles and clay layer before intersecting the Dwyka (Mucina, 2006).

Local Geology:

The local geological succession was based on information from 15 exploration boreholes, 13 of which penetrated the complete succession to the base of the LMO. The sub-surface geology of the Mamatwan project is typical of the regional geology of the area as depicted in *Figure 1*. Only the Olifantshoek Subgroup is not present at Mamatwan. The Kalahari group is present in all of the boreholes and varies in thickness between 72 m and 114 m. All of the boreholes drilled in the KMF intersected the Hotazel formation. The UMO and LMO were intersected in all of the boreholes that intersected the Hotazel formation. The thickness of the LMO varies between 13 m and 32 m.

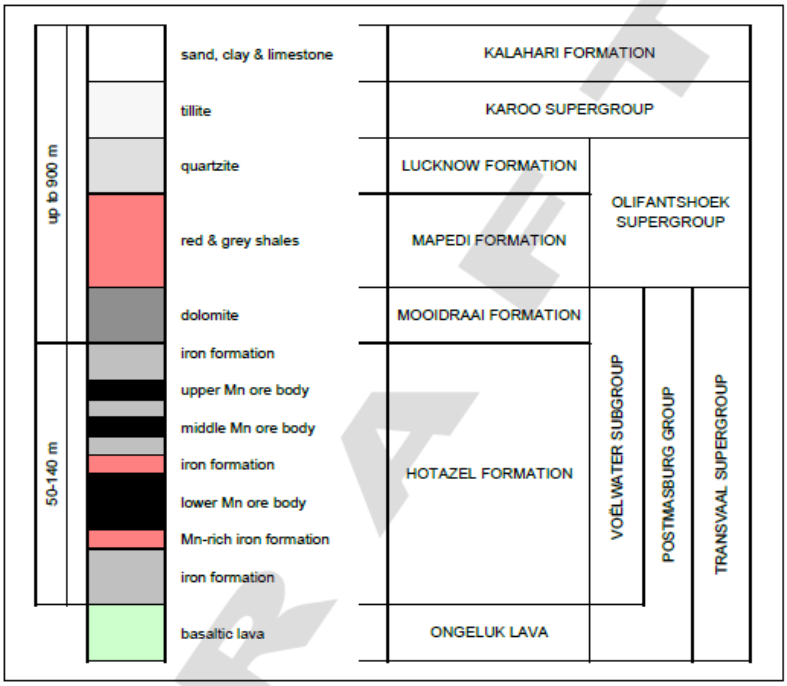

Figure 1: Stratigraphy of the Kalahari Manganese Field (KMF) (Royal HaskoningDHV, 2013)

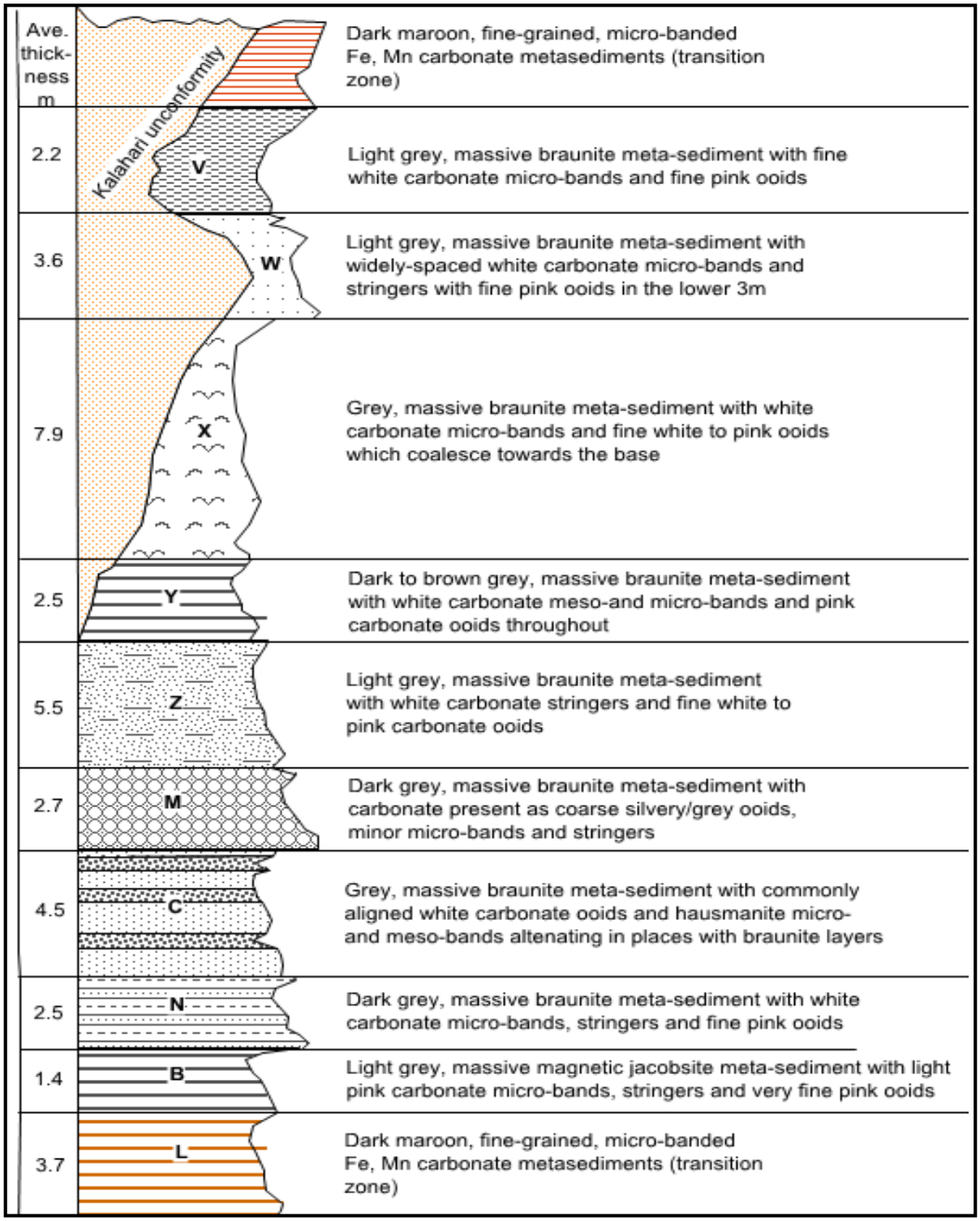

Figure 2: Lithostratigraphic sub division of the Mamatwan type LMO (Royal HaskoningDHV, 2013)

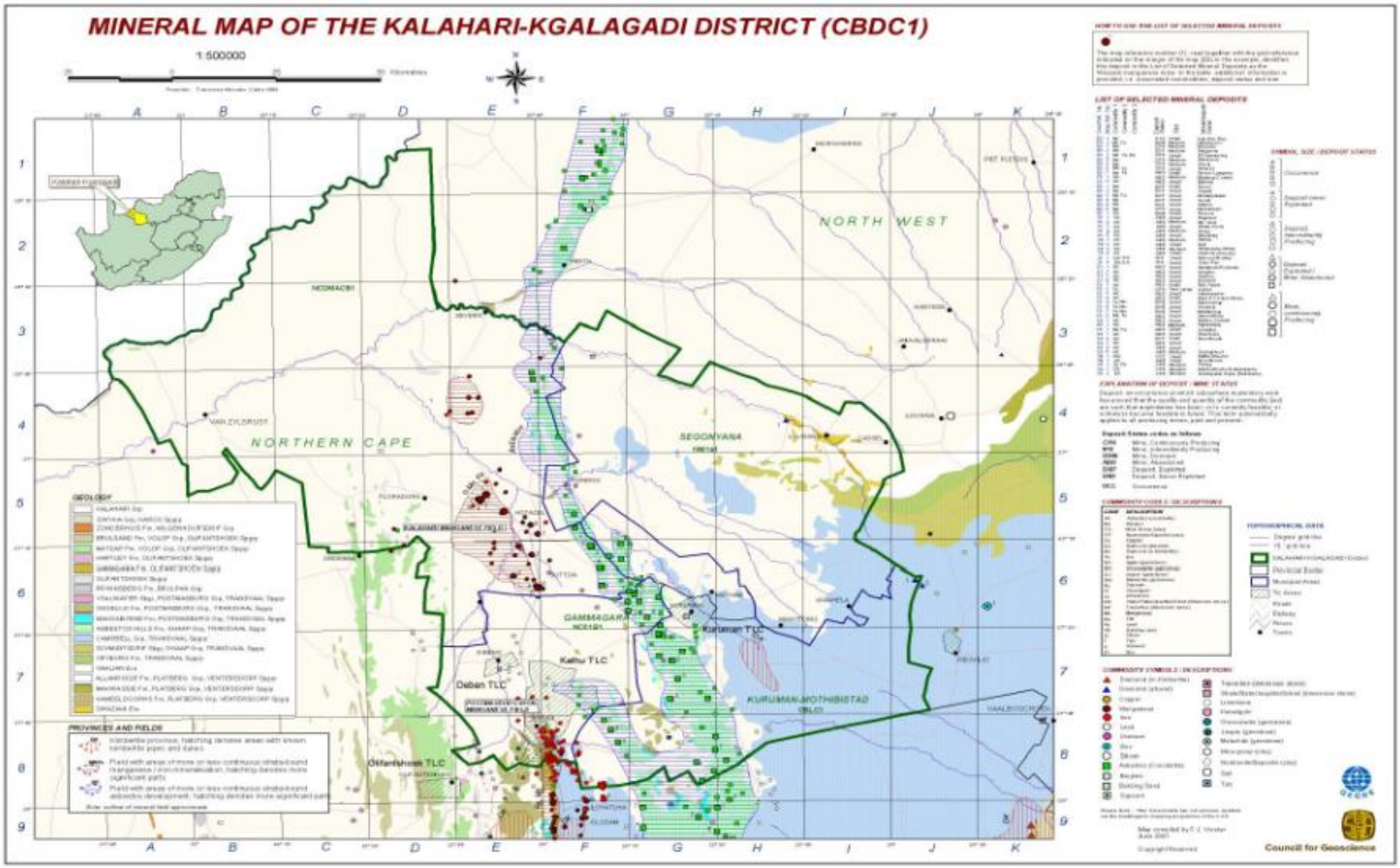

Figure 3: The John Taolo Gaetsewe district municipality (Formerly Kgalagadi) mineral map (Council for Geoscience, 2012)

TOPOGRAPHY

The topography of a particular area will determine the following factors:

- Flow of surface and groundwater;
- Depth of soils and the potential for soil erosion, dependent on the slope of the study area;
- Type of land use;
- Aesthetic appearance of the area; and
- Climatic factors such as wind speeds and direction (which might be influenced by the topography of an area).

Changes in the topography caused by the mining activities could therefore alter all of the above-mentioned aspects of the environment. Project-related activities have the potential to alter the topography of the site through the establishment of both temporary and permanent infrastructure.

The topography of the Kalahari Manganese Field (KMF) is predominately flat-lying at an elevation of less than 1100mamsl and a slope of less in the order of 1:300 (0.003). The area is characterised by several vegetated northwest to southeast-trending red sand dunes, up to 10 m in height, up to 200 m wide and tens of kilometers in length. The regional drainage pattern is broadly northwards but water-flows in the streams are generally very rare.

HYDROLOGY

According to the C-Plan Version 3 database, the site is located within the Lower Vaal: quaternary catchment D41K (*refer to Figure 4 below*), which in turn is located within the Orange Primary Catchment. No permanent surface water features such as dams or lakes are located within the boundaries of the study area. The episodic Vlermuisleegte drainage line runs to the west of the site (*refer to Figure 5 below*). The ephemeral Kuruman River runs approximately 30 km to the southeast of the site. A large catchment of approximately 13 780 km^2 feeds the Kuruman River, and consequently when the river is in flood, flows can become considerable. The Kuruman River is, however, considered ephemeral as the river only produces surface flows during periods of heavy precipitation. The Kuruman catchment is large but sparsely vegetated and features freely draining soils which indicates that minor rainfall events would infiltrate to groundwater as opposed to generating significant volumes of runoff.

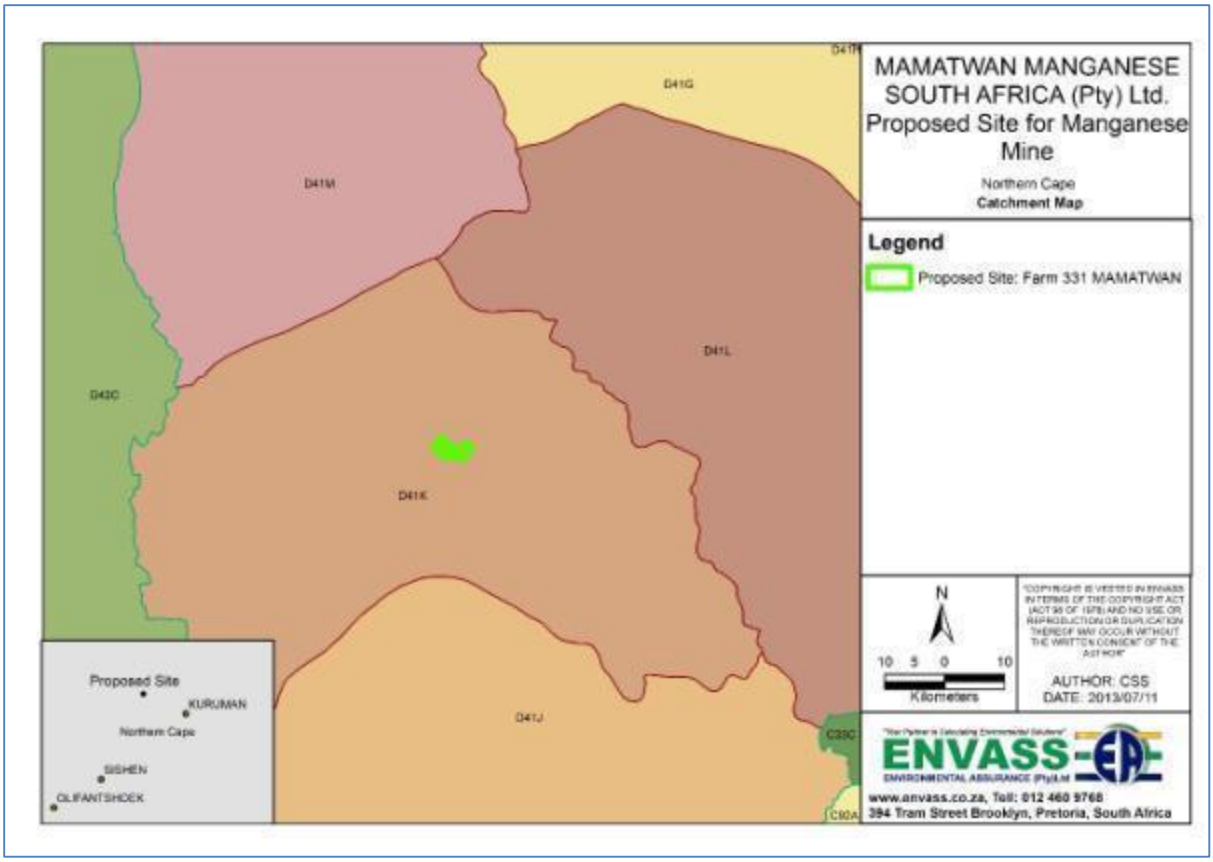

Figure 4: Water catchment areas

SURFACE WATER

Watercourse and Wetland Assessment

The desktop study of the specialist revealed that not many surface water resources were present in the greater study area according to the relevant databases. The National Freshwater Ecosystem Priority Area (NFEPA) database indicated an ephemeral watercourse in the form of the Vlermuisleegte mentioned above, which forms the western boundary of the site. The Vlermuisleegte Watercourse flows in a northerly direction and is a tributary of the Ga-mogara River which in turn flows into the Kuruman River located to the north, northwest of the site. The Vlermuisleegte is located within the Southern Kalahari Eco-region. Over and above the already mentioned, no other wetlands, watercourses or any other surface water features were identifiable within a radius of 1.5 km of the site during the desktop study.

The fieldwork verification and ground truthing assessment was undertaken to scrutinise the results of the desktop study and to identify any overlooked surface water resources in the field. The Vlermuisleegte was confirmed as determined during the desktop study. No other surface water resources were identified on the study site. A graphic illustration is presented in *Figure 5.*

Figure 5: Watercourse delineation map

The Vlermuisleegte is considered an ephemeral watercourse according to the desktop information. However, flow was last reported in the early 1900's by the landowner according to Mr. Andries van den Berg as told to the specialist, suggesting that the watercourse may rather be episodic.

The geomorphic province relevant to the study area is the Kalahari. The Kalahari geomorphic province is essentially a basin filled with sediment (from the Cretaceous to recent age) that was formed by differential marginal uplift, whereby subsequent sedimentation and aridification led to the decrease of surface fluvial activity in the area. The Kalahari geomorphic province therefore mostly consists of dry valleys which is characteristic of the Vlermuisleegte on the site.

Although the topography of the site is relatively flat, it does gradually form a relatively broad valley bottom area (approximately 120 m) in the western section of the site which is the Vlermuisleegte Watercourse. The soil and vegetation characteristics of the watercourse revealed that the watercourse could not be classified as a wetland.

Functionality and Sensitivity of the Vlermuisleegte Watercourse:

The watercourse was found to be dry and colonised by typically terrestrial species. This may provide further evidence to the assessment that the watercourse is episodic. Presumably the surface and sub-surface water movement is scarce enough to the extent that herbaceous and tree species can colonise the valley bottom as oppose to typically hydrophytic vegetation species. Nonetheless, the watercourse is still important for the vegetation and biota that they support. Given the scarcity of water in the area, a system such as this provides unique habitat and can be considered to play an important role despite its enigmatic nature.

GROUNDWATER - GEOHYDROLOGY

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in rock pore spaces and in the fractures of lithologic formations. As a baseline, this section provides a brief description of the pre-mining groundwater conditions to facilitate an understanding of the potential for dewatering cones of depression and pollution plumes to occur as a result of project-related activities.

Regional Hydrogeology:

It is likely that the geohydrological regime in the stud area is made up of two aquifer systems; these being the unconsolidated Kalahari Formation (primary aquifer) and the underlying fractured bedrock (secondary aquifer).

The area covered with Kalahari Formation sand to an average depth of about 90 m, with a clay layer residing at a depth of 50 m. While the sands could have a relatively reasonable hydraulic conductivity, the clay must be assumed to be relatively impermeable. The upper sand layer is a primary perched aquifer and occurs in the calcrete or on the contact with the underlying Kalahari clay formation. This aquifer sustains usually the livestock and domestic water supply. The clay layer form an aquitard and where thick clay layers are developed in this aquifer, a recharge lag time to the underlying aquifer(s) often occurs.

Following this at depth is tillite, quartzite, shale dolomite and several successions of banded iron stone and manganese ore bearing layers. This second, deeper secondary aquifer is associated with fractures, fissures and joints and other discontinuities within the older hard rock geology of the Transvaal Supergroup and associated intrusives. Of all these lithologies, only the dolomite could potentially hold large volumes of water.

Theoretically, water entering the system will migrate vertically downwards until a perched aquifer is encountered and the majority will continue to migrate downwards into the saturated one. From there it will migrate in the direction of the hydraulic gradient until it eventually enters surface water bodies (i.e. rivers or springs) from where it will flow out as surface water.

Local Hydrogeology:

As mentioned above the area is covered with Kalahari Formation sand to a depth of 90 m and locally the Kalahari Formation sand in this area is present as two layers of 40 m thickness each, separated by a clay layer with a thickness of 5 to 15 m at a depth of about 50 m. the clay layer is considered as an aquitard on which groundwater can perch, and hydrogeologically separate the sand layer into two distinct aquifers.

At depth a secondary aquifer is present in the bedrock formations. These formations consist of non-conductive hard rock and hydraulic conductivity is solely dependent on secondary faults and fractures. The exception is the dolomite, but no evidence of significant dissolution cavities exist in the available exploration data.

The local effect of discontinuities, such as faults, fractures and intrusions was not taken in consideration as the exact location and characteristics of these structures are unknown. On a large enough scale the effect of these structures become less important and can be considered as part of the homogeneous aquifer.

Based on this the following assumptions were made regarding the local hydrogeology and the subsurface in the proposed mining area were envisaged to consist of the following four distinct hydrogeological layers:

- A 40 m upper unit of unconsolidated Kalahari sand;
- A 10 to 15 m impermeable clay layer;
- A 40 m poorly consolidated Kalahari sand layer; and
- The final unit consist of fractured bedrock.

Hydrocensus

A hydrocensus was conducted in January 2014. A total of 25 boreholes were identified during the study. Twelve privately owned boreholes were identified, which are mainly used for domestic use and livestock watering. The other thirteen are exploration boreholes and not in use. The potential groundwater receptor in the area will be the surrounding aquifer and the Vlermuisleegte watercourse. Several farmers in and around the area is reliant on groundwater as probably a sole source of water supply to the farm household and community. Water levels measured in all the private boreholes indicate a shallow water table at about an average of 22 m below surface. Geological studies in the area indicate the presence of a thick clay layer at

about 50 m below surface, and these shallow water tables are most probably due to a perched aquifer in the upper sand layer.

Water levels

Groundwater levels were measured in 18 boreholes. The depth of the groundwater was found to very between 19 m and 104 m below ground level. This unrealistic range in groundwater levels are due to the fact that a 10 m clay layer hydrogeologically separates the Kalahari sand layer in two distinct aquifers, namely an upper perched aquifer and a secondary bedrock aquifer.

Water quality

From the chemical analysis it is evident that the groundwater sampled in the area is not of acceptable drinking water quality mainly due to the high concentrations of nitrate, calcium and magnesium. The groundwater in the proposed mining area is acceptable for livestock watering according to the DWA guidelines. It can be deduced from the water quality of the sampled boreholes that the groundwater in and around the proposed mining area has been negatively affected, from natural or anthropogenic origin.

Aquifer sensitivity

The term aquifer refers to a strata or group of interconnected strata comprising of saturated earth material capable of conducting groundwater and of yielding usable quantities of groundwater to boreholes and / or springs. In the light of Sought Africa's limited water resources it is important to discuss the aquifer sensitivity in terms of the boundaries of the aquifer, its vulnerability, classification and finally protection classification, as this will help to provide a framework in the groundwater management process.

The outcome of the study was that the aquifer is reasonably sensitive to contamination and care should be taken with any activities that could generate pollutants. The aquifer was classified according to the Aquifer system Management Classification document of the Department of Water Affairs and the Water Research Commission. The aquifer system in the study area can be classified as a "Sole Source Aquifer System", based on the fact that the local population is dependent on only groundwater.

The estimate of the classification rating system for the aquifer is that a Strictly Non-degradation groundwater protection is required for the primary unconsolidated sand aquifer. Reasonable and sound groundwater protection measures are recommended to ensure that no cumulative pollution affects the aquifer, even in the long term. DWA's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that if any potential risk exists, measures must be taken to limit the risk to the environment, which in this case is:

The saturated aquifer perched on the clay layer would be an important pathway, and also the most important receptor This aquifer is the sole source of water for many farming communities and is considered very important; and

The Vlermuisleegte watercourse.

CLIMATE

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

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

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

The Northern Cape is mainly semi-desert, its weather typical of desert and semi-desert with fluctuating temperature and varying topography. The annual rainfall is sparse ranging from 50-400 mm per annum mainly between January and April, whilst the summer temperature in the afternoon ranges from 34-40˚C and might even peak above the 40˚C mark. Winter days are favourably warm while nights are characterised by dew and frost. Mean annual temperatures range between 16 and 20°C. The mean annual minimum/maximum temperatures are estimated to range between 8 and 28°C. The seasonal temperature patterns for Kuruman, as well as the highest recorded maximum and lowest recorded minimum temperatures per month, is expected to be largely representative for the whole of the John Taolo Gaetsewe District Municipality.

Rainfall:

The annual rainfall in the area is sparse ranging from 50-400 mm per annum mainly between January and April. The monthly average rainfall values ranging between 16 and 19 mm, whilst the lowest rainfall records are recorded for the months of June, July and August, with monthly average rainfall values ranging between 0 and 3 mm (EIA Kalahari Manganese Mine, SEF 2007). The rainfall erosivity for the site is estimated at 501-600mm per year (*refer* to Figure 11 *below*).

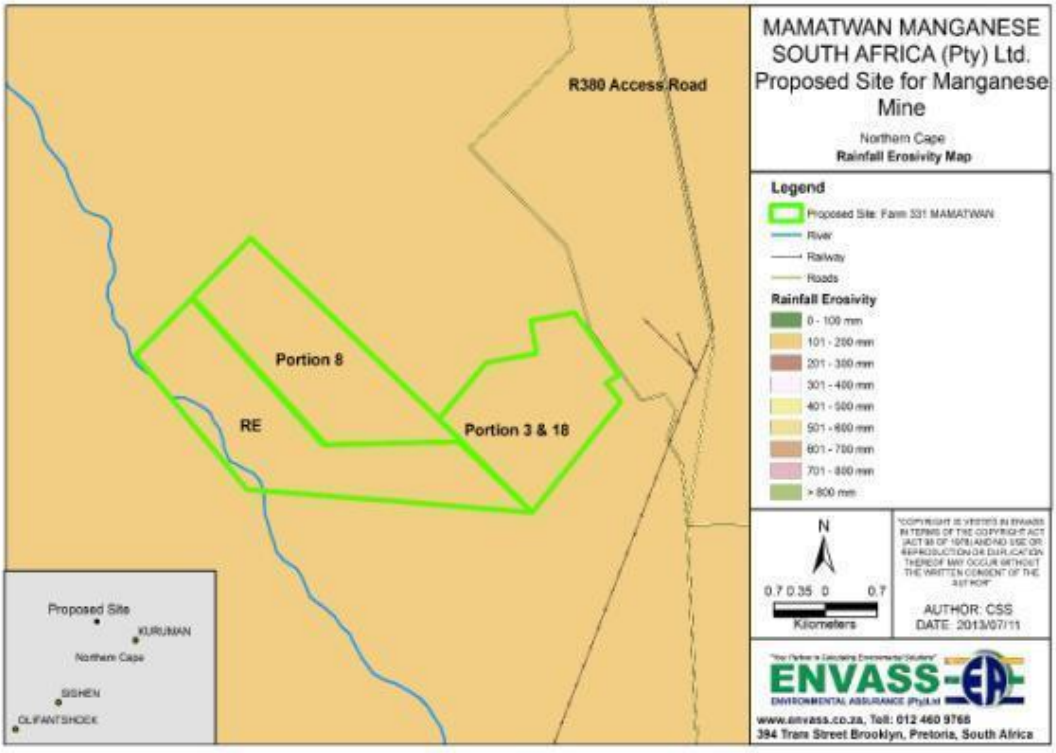

Figure 6: Rainfall Erosivity Map

Wind and evaporation:

The predominant wind direction in the Kuruman region is south-easterly (12 to 17 %) (*Refer to* Figure 7*below*) with frequent winds also occurring from the North West (8 %). Less frequent winds (~6 % of the time) are from the north-easterly and south-westerly sectors. Calm conditions (wind speeds < 1 m/s) occur for ~12 % of the time. Wind roses for day / night periods and seasonal wind roses are included below (SA Weather Bureau and Airshed 2006). The annual evaporation rate at the site is estimated at a range between 2201 and 2400mm (Refer to Figure 8below).

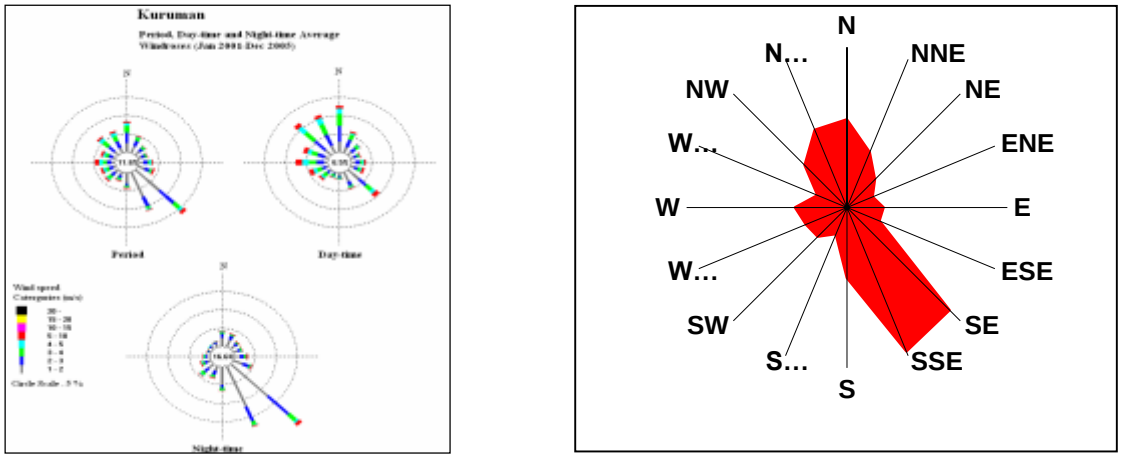

Figure 7: Total wind frequency distribution at Kuruman

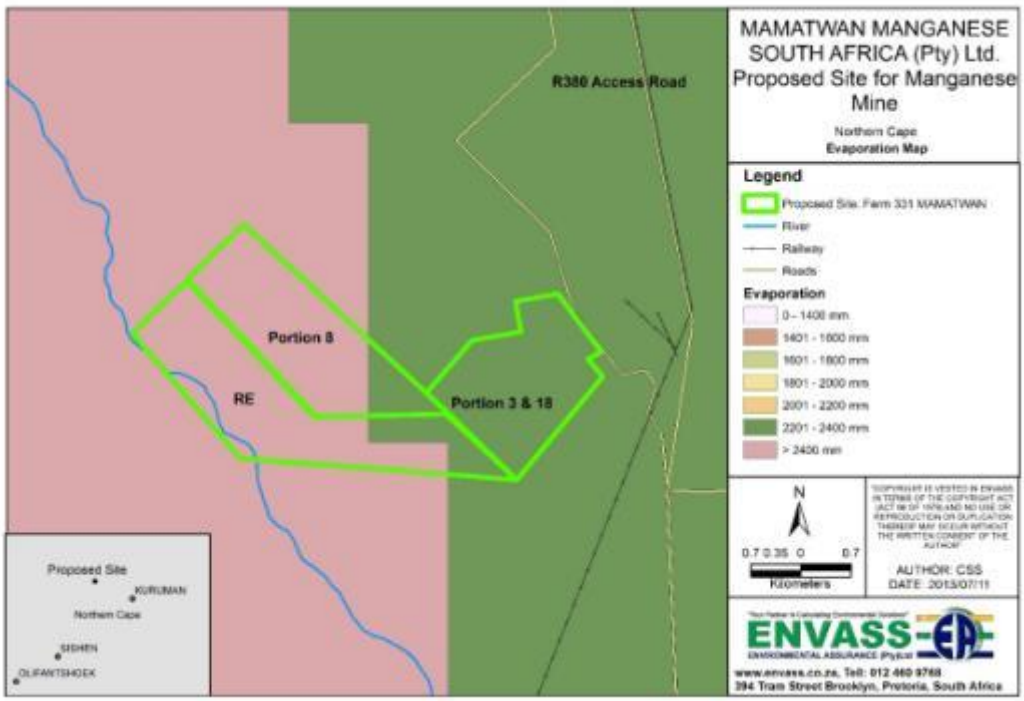

Figure 8: Evaporation of the study area

BIODIVERSITY

Biodiversity forms one of the most crucial environmental considerations of a development and it is used to formulate decisions pertaining to activities with significant environmental impacts. The inclusion of biodiversity in decision making has been aimed to bridge a gap between economic development and land destruction, thus mitigating the environmental effects these developments may pose while still maintaining a functioning biodiversity. Therefore, as part of the EIA guidelines it is important to assess the potential impact of these proposed activities as they can impact directly or indirectly on the receiving environment. In general, biodiversity represents the variety of species within a specified ecosystem and can thus be used to assess the ecosystem health.

Flora

The study area falls within the Savanna Biome (*Refer to* Figure 9*below*), which is characterised by the Kalahari Bushveld vegetation and Khathu Bushveld vegetation units. The unit occurring on the study area is the Khathu Bushveld vegetation unit (SVk12). During the time of the assessment the province had not experienced any summer rainfall yet, thus its vegetation was still in an arid state. Therefore, only two floral communities were observed however seasonal flora that is expected at the study area was listed in the ecological assessment.

There were three representatives of floral communities on the site as follows:

- The trees;
- The gramnoid; and
- The shrubs.

Trees were represented by *Acacia erioloba*, *Boscia albitrunca* and *Acacia heamoxtylon* whereas the shrubs were represented by *Tarchonanthus camphoratus*, *Acacia karoo*, *Acacia mellifera* subsp. *detinens*, and *Grewia flava*. The gramnoids were represented by *Stipagrostis ciliata*.

Except for the few trees that are found on the site; the area has a low species carrying capacity due to the abiotic environmental factors i.e. low rainfall and high wind potential present that are not conducive to species diversity survival.

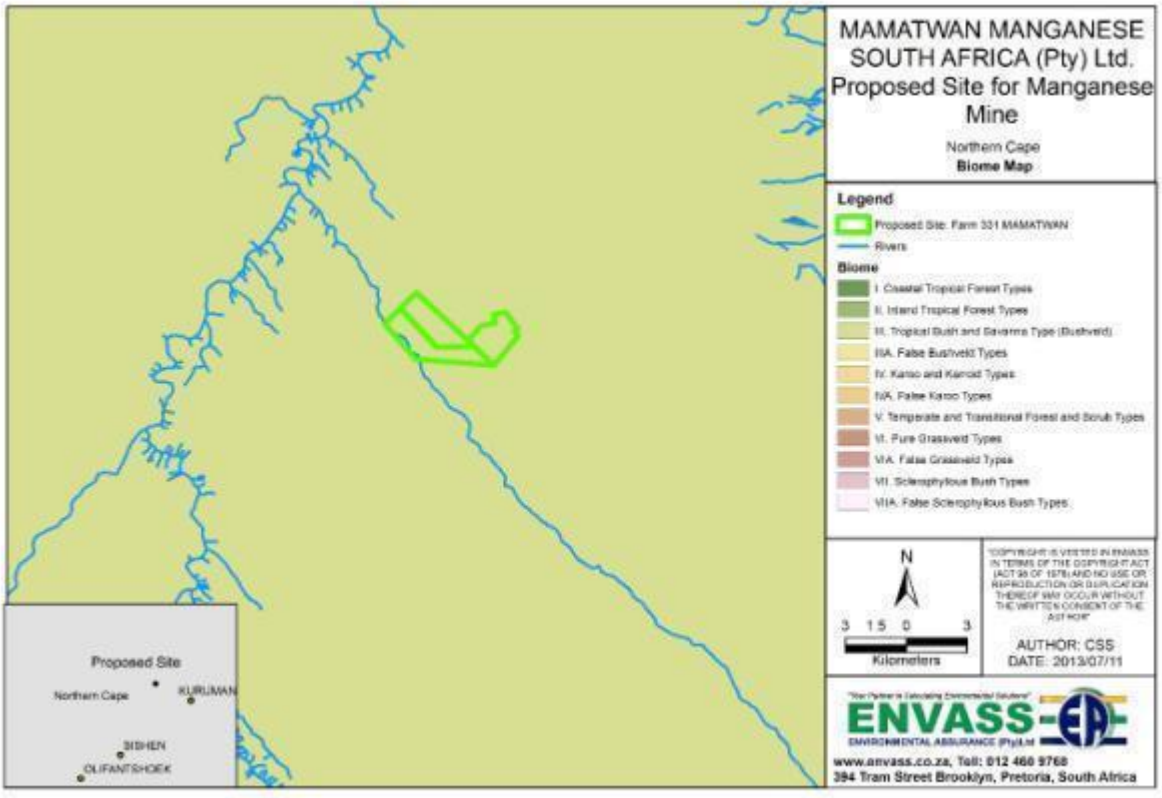

Figure 9: Biome Map

Table 1 below summarizes the vegetation types found in the Northern Cape Province:

Table 1: Types of vegetation and the size of the province it occupies

VEGETATION TYPE	SIZE IT OCCUPIES
Gordonia Duneveld	149 613.5 (13.99%)
Gordonia Plains Shrubland	62 287.4 (5.82%)
Kathu Bushveld	517 310.3 (48.37%)
Koranna-Langeberg Mountain Bushveld	6681.4 (0.62%)
Kuruman Mountain Bushveld	14 473.7 (1.35%)
Kuruman Thornveld	40 694.1 (3.81%)
Molopo Bushveld	201 283 (18.82%)
Olifansthoek Plains Thornveld	4 205.9 (0.39%)
Southern Kalahari Mekgacha	71 620.4 (6.7%)
Southern Kalahari Salt Pans	1 042.2 (0.1%)

Statistically, most of the vegetation types of the Northern Cape have been extensively degraded, however the degradation and transformation is often localised, thus making the province percentage of transformation low (about 4%). In terms of biodiversity, the Northern Cape Province boasts a total of 4 864 taxa of which 1 302 are recorded to be endemic to the province. 23.5% of the country's flora occurs within the Northern Cape, making it the province with the fourth highest percentage of floral occurrence. However, 295 of the taxa found within the province is threatened with 236 of the threaten taxa being endemic, listing the Northern Cape as the province with the third highest number of threatened flora. Only 739 of all the taxa within the province are of conservation concern of which 584 are endemic. This makes the Northern Cape the province with the second highest number of species or taxa of conservation concern (April, 2012).

Protected Species

The *Acacia erioloba*, *Acacia heamoxtylon* and *Boscia albitrunca* are endangered. These trees are considered important and nationally protected under the National Forestry Act, 1998 (Act No. 30 of 1998). A tree removal license should be applied for at the Department of Agriculture, Forestry and Fisheries (DAFF) for the protected species should the proposed project be authorised.

Acacia erioloba has been declared as rapidly declining in quantity. The main reasons for its decline are the effects of droughts and vegetation clearing for development activities such as mining and infrastructure. The species is considered by the South African National Biodiversity Institute (SANBI), as a species of special concern, due to the importance of *Acacia erioloba* for ecosystem functioning. Important functions of the tree for the ecosystem include: ability to transform dryer landscapes; providing shade for animals; their pods serves as fodder and coffee surrogate; their bark serves as fire fuel; and their roots have medicinal properties.

Figure 10: *Acacia erioloba* stand among *Acacia mellifera* in the background

Alien, invasive plants and noxious weeds

Alien and invasive plants are opportunistic plants that invade disturbed areas, thus competing and replacing endemic plants. They have the potential to degrade the area and make it more susceptible to fire as their fuel content is high and they use more water than indigenous plant species.

Historic and current land uses e.g. infrastructure development, mining, agriculture and mismanagement of the environment, disturbed the environment on and surrounding the study area. This resulted in the area being susceptible to alien and invasive plant invasion. In terms of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA), alien and invasive plants are to be controlled and prevented.

The area in which the proposed activity will take place is already prone to bush encroachment and further disturbance may trigger alien invasion; thus, rehabilitation measures should be considered and be implemented accordingly should the proposed activity be authorised. Replacement of weedy plants with indigenous or economical important plant species should be a priority.

Fauna

Although the faunal carrying capacity of the study area is low, it is still regarded as a possible area for faunal species distribution. Tracks of the species *Naja nivea* (Cape Cobra) was observed on the study area and *Sylvicarpa grimmia* (Common Duiker) was observed in the shade of an *Acacia erioloba* tree. It is expected that more species could randomly occur on the site, however, no known species would formally inhabit the area solely.

No fauna species of special concern or protected species or species listed as threatened or endangered were identified or observed on the study area. However, this does not rule out the importance of each species occurring on the study area, as they play an important role in ecosystem functionality and the ecology of the area investigated.

SOCIO-ECONOMIC PROFILE

Reference is made to the Social and Labour Plan (*Annexure 3*) compiled by Dr. Martin Carstens for the baseline socio-economic information. The socio-economic baseline information is to contribute meaningfully towards community development. The mine contributions towards the community relates to principles of the social license to operate.

The study area is located within the municipal boundaries of the John Taolo Gaetsewe (formerly Kgalagadi) District Municipality. The John Taolo Gaetsewe District municipality occupies a sizable 27 283km^2 (square kilometers) of the northern part of the Northern Cape Province. Employment opportunities are concentrated around Kuruman and the mines situated around Kathu, Hotazel and Black Rock.

The John Taolo Gaetsewe District Municipality consists of three Local Municipalities:

Joe Morolong Local Municipality (previously Moshwaneng), which is located in Mothibistad. The municipal area of the Joe Morolong has the following characteristics:

- Approximately 20 172 km^2 in size;
- Includes the settlements/towns of Hotazel, Santoy and Van Zylsrus;
- Includes approximately 152 residential areas;
- A population of approximately 89 530 and about 23 707 households; and
- A population growth of 0.90% per annum and an unemployment rate of 38.60%.

Gamagara Local Municipality which is located in Kathu which has the following characteristics:

- An area of 2 619 km^2;
- A Category B municipality located in Kathu with the Central Business District (CBD) located here;
- The other four towns within this municipal boundaries includes Sesheng (just outside Kathu), Dingleton, Dibeng and Olifantshoek;
- A population of approximately 41 617 and about 10 808 households; and
- A population growth of 5.84% per annum and an unemployment rate of 17.70%.

Ga-segonyana Local Municipality located in Kuruman which has the following characteristics:

- A municipal area of 4,492 km^2;
- Category C municipality which was established in 2000 through the amalgamation of Kuruman and Mothibistad municipalities and includes sections of the Bophirima District municipality;
- Approximately 80% of the population reside in rural villages;
- The area is administered through a traditional authority system with two paramount chiefs and headmen;
- Towns/settlements are Bankhara-Bodulong and Mothibistad;
- A population of approximately 93 651 and approximately 26 816 households; and
- A population growth of 2.85% per annum and an unemployment rate of 33.70%.

The proposed Mamatwan Manganese Mine will have a significant positive impact on the baseline socio-economic conditions of the local communities, since unemployment is a major problem within the district. The mine will create several employment opportunities and preference will be given to the locally unemployed wherever possible. Employment should be sourced from the local community and the Industrial Policy Action Plan (IPAP) be implemented. Employment will be created in phases including the construction, commissioning, production (operational), decommissioning and rehabilitation phases. During these phases, employees will mainly be recruited from the Joe Morolong Local Municipality (mainly Hotazel) then the District Management Area, in general and thereafter the rest of the province. About 300 – 500 people will be employed during the construction phase.

The mining site is accessible through a well maintained dirt road which is connected to the main tarred road the R31, between Hotazel and Kathu in the Northern Cape Province.

VISUAL

It is important to bear in mind that determining a visual resource in absolute terms is not achievable. Evaluating a landscapes' visual quality is both complex and problematic, as many quality standards apply and it is largely subjective, with individuals basing evaluations on experiences, their social level and their cultural background.

Furthermore, natural features are inherently variable. Climate, season, atmospheric conditions, region and sub-region all affect the attributes that comprise the landscape. However, in this case the landscape is more uniform because of the extent of the study area. In addition to this the surrounding area is characterised by mining and agricultural activities. The proposed study area is surrounded by existing underground manganese operations as well as agricultural activities.

The mining activities will take place underground; therefore the visual disturbance for the surrounding area will be limited to the stockpiles only. The stockpiles will be visible from viewpoints in all directions. However the surrounding area is scarcely populated with no major tourist routes or areas close by.

HERITAGE RESOURCES

Cultural resources are all non-physical and physical man-made features as well as natural features associated with human activity. These include all sites, structures and artefacts of importance; whether individually or in a group, in the history, architecture and archaeology of human (cultural) development. Graves and cemeteries are included in this.

The significance of the sites, structures and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. The various aspects are not mutually exclusive, and the evaluation of any site is done with reference to any number of these aspects.

Observed resources on the Remaining Extent of the Farm Mamatwan 331:

A number of archaeological sites / resources of significance were identified across the study area. These include five marked graves, a homestead and vineyard as well as several other buildings on the property, dating to the Historical Period, and scattered stone tools of the Late Stone Age (LSA).

The graves are located within a fenced graveyard, in close proximity to the homestead. These are family graves of the owner of the Remaining Extent of the Farm Mamatwan 331. The oldest grave dates to 1953 and the most recent one to 2000. Should these graves be impacted on or would other graves be discovered during construction and operational activities the following will apply: The National Heritage Resources Act, 1999 (Act No 25 of 1999)

and the Human Tissues Act, 1983 (Act No 65 of 1983) protect graves older than 60 years. Graves younger than 60 years, are protected under the Human Tissue Act, 1983 (Act No. 65 of 1983) and fall under Section 2 (1) of the Removal of graves and Dead Bodies Ordinance, 1925 (Ordinance No. 7 of 1925). The exhumation of graves falls under the jurisdiction of the National Department of Health and the relevant Provincial Department of Health. Exhumation permission must also be obtained from the relevant local or regional council were graves are located, and from the relevant regional and local council to where the grave will be relocated.

The homestead was built in 1922, therefore older than 60 years and thus protected under the National Heritage and Resources Act, 1999 (Act No. 25 of 1999). According to the landowner his ancestors were of the first people to move to the specific area. Such information might be useful in terms of a regional context. Adding to this is the fact that the family graves are located in close proximity to the original homestead. The vineyard was established in 1930. The other buildings on the property which dated to the Historical Period were destroyed by wind storms and demolished by the owner a long time ago.

A stonewall was observed within the river channel and might be of recent origin. However a possibility exists that this feature might have its origins in the Historical Period. The river and its surroundings as a source of water would have been a key area for past human settlement, especially since the river might have been a perennial river.

The scattered stone tools of the Late Stone Age (LSA) were observed within a 200 m radius along the riverbed on the Remaining Extent. This specific area is important and the area should not be disturbed by any activities. No significant concentrations of stone tools or any other archaeological sites dated to the LSA were observed.

Resources on Portions 3, 8 and the demarcated section of Portion 19:

No sites of heritage importance were observed on these properties. A significant portion of the demarcated section of Portion 19 has already been developed.

It should be noted that the significance of the larger historical and pre-historical landscape within the Kuruman district are the archaeological site of Wonderwerk Cave, which is classified as a provincial heritage site.

NOISE AND VIBRATION

Existing noise sources on site and the immediate surrounds include:

- Agricultural activities on surrounding land;
- Mining and mining activities at the mining areas across to the East of Portion 3 and the R381 road; and
- Vehicles servicing the existing mines and farming communities.

AIR QUALITY

Air quality monitoring has not been undertaken at this stage of the project as no mining activities has commenced on site. Sulphur Dioxide and other particulates represent pollutants that raise concerns in assessing the impact of the mines operations. The levels of these pollutants are also known to be elevated in other parts of South Africa and especially in Mpumalanga (also renowned for mining) as a result of mines as well as ESKOM electricity generation activities.

Air quality monitoring and modelling should for future activities concentrate on dust fallout and ambient PM_{10} and sulphur dioxide monitoring. Dust fallout monitoring will be undertaken to assess compliancy with dust fallout limits and will be reviewed annually. Monitoring will also be undertaken during the mining phase to assess sulphur dioxide compliancy with the ambient air quality guidelines and standards. The monitoring is conducted according to the main impact zone of the mine operations.

Dust originating from disturbed areas and mining operations as well as vehicle emissions may contribute to poor air quality. Current sources of pollution (predominantly in the form of dust) in the vicinity of the site include the following:

- Dust from mining;
- The handling of ore;
- Ore processing operations;
- Stockpiled materials at the mines;
- Disturbed land or land denuded of any vegetation;
- Vehicle movements on un-surfaced roads; and
- Disposal facilities.

Mining activities in the general region as well as burning of wood and coal by the residents of many of the local communities (due to there being no formal electricity infrastructure), are primary contributors to the air pollution experienced in the region.

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.

TOPSOIL

The significant impact of loss of topsoil will occur due to the initial vegetation clearing on site, the establishment of the construction camp as well as due to the movement of people and vehicles on bare ground on site. These areas are highly susceptible to erosion as the lower density of vegetation reduces the energy dissipation effect on water flow. This effect will be more pronounced on slopes, therefore increasing the erosion potential and the amount of sediment carried to the neighbouring waterways.

WATERCOURSE

The only surface water feature occurring on the study area is the Vlermuisleegte Watercourse which forms the western boundary of the study area. This watercourse is dry and is classified as episodic.

All water courses have a conservation value and are therefore considered to be sensitive and may require protection or remediation.

The risk assessment revealed that the development will only pose a low risk to the watercourse. The potential degree to which the proposed development will result in a direct impact on a water course is classified as high risk. The potential degree to which the proposed development will result in an impact on the buffer zone of the identified watercourse is classified as a medium risk. Given that the proposed development would not be in the watercourse, the type of impacts would be considered to be indirect impacts. The potential degree to which the proposed development will result in an impact between the area outside of the 100 m buffer zone and within a distance of 500 m from the watercourse is classified as Low risk.

In this instance, all proposed structures and infrastructure (including the railway siding) are not to take place directly inside the watercourse or within the 100 m buffer zone. Hence no direct impacts are anticipated. However, the railway siding is approximately 90m from the edge of the 100 m buffer zone and would fall within the Low Risk category. Indirect potential impacts can be anticipated that would need to be mitigated against.

GROUNDWATER

The outcome of the geohydrological study was that the aquifer is reasonably sensitive to contamination and care should be taken with any activities that could generate pollutants. The aquifer was classified according to the Aquifer system Management Classification document of the Department of Water Affairs and the Water Research Commission. The aquifer system in the study area can be classified as a “Sole Source Aquifer System”, based on the fact that the local population is dependent on only groundwater.

The estimate of the classification rating system for the aquifer is that a Strictly Non-degradation groundwater protection is required for the primary unconsolidated sand aquifer. Reasonable and sound groundwater protection measures are recommended to ensure that no cumulative pollution affects the aquifer, even in the long term. DWA’s water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that if any potential risk exists, measures must be taken to limit the risk to the environment,

FLORA

Protected Species

The *Acacia erioloba*, *Acacia heamoxtylon* and *Boscia albitrunca* trees occurring on the study area are endangered species. These trees are considered important and nationally protected under the National Forestry Act, 1998 (Act No. 30 of 1998). A tree removal license should be applied for at the department of Agriculture, Forestry and

Fisheries, for the protected species should the proposed project be authorised.

Acacia erioloba has been declared as rapidly declining in quantity. The main reasons for its decline are the effects of droughts and vegetation clearing for development activities such as mining and infrastructure. The species is considered by SANBI as a species of special concern, due to the importance of *Acacia erioloba* for ecosystem functioning. Important functions of the tree for the ecosystem include: ability to transform dryer landscapes; providing shade for animals; their pods serves as fodder and coffee surrogate; their bark serves as fire fuel and their roots have medicinal properties.

HERITAGE

A number of archaeological sites / resources of significance were identified on the Remaining Extent of the Farm Mamatwan 331. These include five marked graves, a homestead older than 60 years and scattered stone tools of the Late Stone Age (LSA).

The graves are located within a fenced graveyard in proximity of the homestead. These are family graves of the owner of the Remaining Extent of the Farm Mamatwan 331. The oldest grave dates to 1953 and the most recent one to 2000. The homestead was built in 1922 and thus older than 60 years and therefore protected under the National Heritage and Resources Act, 1999 (Act No. 25 of 1999). The scattered stone tools of the Late Stone Age (LSA) were observed within a 200 m radius along the riverbed on the Remaining Extent, these also require protection.

It should be noted that the significance of the larger historical and pre-historical landscape within the Kuruman district are the archaeological site of Wonderwerk Cave, which is classified as a provincial heritage site.

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.

Land use: In terms of land use the area is predominantly characterised by mining in the greater area and by agriculture, mostly stock farming and game farming. Therefore the potential impact on land uses in terms of socio-economic conditions is deemed to be minimal.

The study area is located within an area already severely disturbed as a result of agricultural and extensive mining activities. Most of the mining activities within the Joe Morelong and Ga-magara municipalities are connected to the Sishen-Saldanha and Sishen-PE railway routes. To this effect, the following mining and exploration activities occur within the surrounding area:

- Wessels Mine (underground operation)
- Tshipi Mine (opencast mining)
- Mamatwan Mine (opencast mining)
- UMK Mine (opencast mining)

- Kudumane (opencast mining)

The proposed mine will be located adjacent to the west of the existing Mamatwan Mine (owned by Samancor).

Heritage: Heritage features of significance occurring on the site include five marked graves, a homestead to the Historical Period, and scattered stone tools of the Late Stone Age (LSA). The graves are family graves of the owner of the Remaining Extent of the Farm Mamatwan 331. It is possible that these heritage features may be impacted on by the mining activities before mitigation, which in turn will have socio-economic impacts on the resident family.

The only parties whose socio-economic conditions with regard to heritage features might be affected are the landowners of the Remaining Extent, however with mitigation there will be no impact.

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

The map annotating the spatial locality, aerial extent, layout plans depicting environmental, cultural/heritage, infrastructure and land use is attached *Annexure 7: Maps and GIS*.

1.5 Confirmation that supporting documents in the form of specialist studies are attached as appendices.

The specialists' reports pertaining to the proposed manganese mine are attached in *Annexure 3: Specialists Reports*.

2. The proposed mining operation

2.1 The mineral to be mined.

The mineral to be mined is manganese ore.

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.

Mining methods vary widely and depend on the location, type and size of mineral resources. Typical mine infrastructure includes haul roads; spoil dumps; surface and underground facilities (e.g. offices, workshops, car parks and warehouses); tailings and waste rock disposal areas; transport and service corridors (e.g. roads, pipelines, conveyers, power and water corridors); product stockpiles; chemicals and fuel storage and housing facilities (AEPA, 1996).

UNLESS OTHERWISE STATED, THE INFORMATION CONTAINED BELOW REGARDING THE MINING DESIGN, METHODOLOGY AND INFRASTRUCTURE PROPOSED FOR THE MAMATWAN MANGANESE

MINE, HAS BEEN EXTRACTED DIRECTLY FROM THE LATEST CONCEPT ENGINEERING STUDY (ROYAL HASKONINGDHV, 2013 – Annexure 4 – Technical Information).

MINING DESIGN AND METHODOLOGY

Table 2 below illustrates the mine design criteria applied in the latest concept study (Royal HaskoningDHV, 2013).

Table 2: Mine design criteria

Key Design Criteria	Values
Production	100,000 tpm
Primary access	Trackless Twin Decline,
Secondary access	On reef decline
Rock Hoisting	Truck
Men and Material movement	Trackless Decline
Stoping method	Room and Pillar
Shift system	5 day week
Labour	Gate wage
Service water tonnes per tonne of rock	1 for stoping, 0.6 for development
Ventilation (allowance for methane)	6 m^3/sec/kiloton/month
Support	2 m Full column resin bolts at 2.5 m^2 per bolt
Dilution	0% (ore body is thicker than the mining cut)

The mining method adopted for this study is room and pillar, the standard method in use throughout the KMF where underground mining is required. Owing to the average height or thickness of the ore body of 11 m it is possible that in the steeper areas drift open stoping could be considered as an alternative if the project proceeds to the PFS level.

The room and pillar method adopted is based on mining the rooms and splits to spans of 7 m in 2 cuts, a 5 m high top cut and 6 m high bench. The pillars are sized at 8 m x 8 m to cater for the overall mining height of 11 m.

The mining operation will be divided into 9 room sections covering a total section extent of 127 m; which caters for two main design requirements:

- The geotechnical requirement for 20 m wide regional pillars at a maximum spacing of 135 m; and
- The 9 room section optimises the utilisation of the equipment suite for the blast hole drilling, support, rock handling and peripheral activities in the section. Previous experience at the neighbouring Middelplaats Manganese operation averaged three blasts per day per section.

It is planned to mine a 5 m high top cut followed by benching the 6 m to the final 11 m height. It is intended to employ horizontal drilling on the benches to standardise the drilling equipment. Each blast in the top cuts and benches are expected to produce 530 t and 604 t respectively from face advances of 4.2 m from 4.6 m blast holes. The Mamatwan manganese ore body is ideally suited to utilising top of the range drilling and rock handling equipment. This will allow the production of 100 000 tonnes per month from 4 suites of equipment in 2 top cuts and

1 bench section with the 4th suite used in advancing the ramp access and providing back up for the other suites. It is planned to blast 3 faces per day on 21 days (5 day week) per month to produce 32 000 tonnes and 36 000 tonnes per top cut and bench section respectively.

Life of Mine Schedule (Primary and Secondary Access)

Primary: A single boxcut to access both declines will take approximately 3 months to establish. The two declines (6 m by 6 m in section) will be developed through the over burden. This will take approximately 17 months, at an average advance rate of 40 m per month to access the ore body. A maximum advance rate of 80 m per month through good ground conditions is anticipated whilst a minimum advance rate of 20 m per month through the poor ground conditions (clay) has been factored into the development schedule .The necessary surface infrastructure will be established in conjunction with the sinking of the declines. This includes a blind sink ventilation shaft which will be required for mine ventilation requirements.

Secondary: On completion of the two declines through the waste material, the on-reef development access will begin in month 21 with the concurrent development of two ore declines and two ledging drives, one on either side of the ore declines. All four development ends will be 5 m in width and 5.3 m in height. It is assumed that these ends will advance together at 40 m per month. The processing plant will take approximately 12 months to construct. This construction will take place in parallel with the build-up of ore production. The processing plant will be completed prior to the mining operation achieving its full production rate.

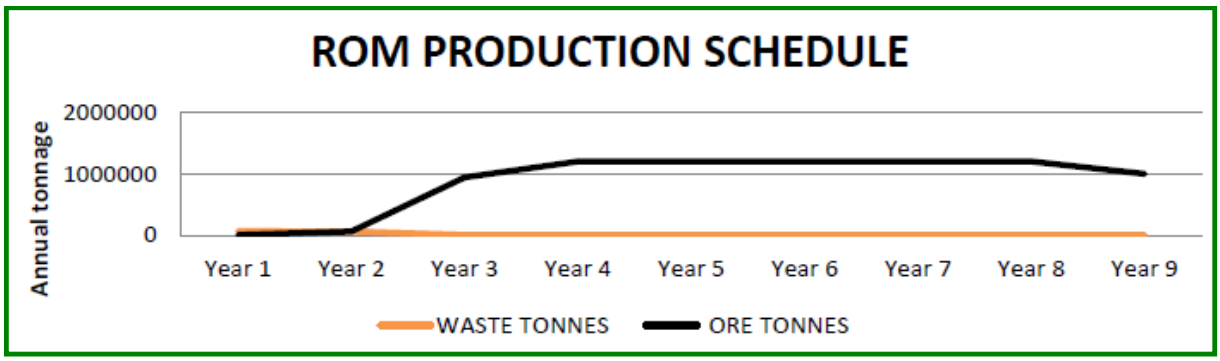

Figure 11: Rom Mine Production Schedule

Production build-up

At the 40 m per month development rate, the reef access declines and ledging development will open up the first production section in approximately four months. The subsequent two ore production sections will be available to produce by production month ten. The combination of three sections and the reef access development will produce 100 000 tonnes per month. In summary, it will take 20 months to develop declines through the waste material underground to get to the manganese reef, and a further 10 months to get up to full production of 100 000 tonnes per month (see Figure 15 above).

Ventilation

Adequate ventilation systems will be installed. This system will be in line with the legal requirements of the Mine Health and Safety Act and Regulations. The purpose of ventilation is to provide fresh air for human respiration and to dilute and remove pollutants. In the case of shallower mechanised mines, the principal pollutants are diesel exhaust gases, heat in the proximity of diesel machines and dust generated from mining and transportation operations. Another pollutant that must be addressed is flammable gas.

During the design of the ventilation system due regard will be given to practicality, the safety of the workforce and equipment against pollutants, heat, the effects of a fire and to provide an acceptably short re-entry interval after blasting. A full Ventilation computer simulation model of the mine would be constructed to determine accurate airflows, cross over sizes and accurate fan operating points. The ventilation system is designed to cater for the following:

- Initial development of the surface declines;
- Production rate of 100 000 tonnes per month based upon the active diesel powered fleet; and
- Leakage allowance appropriate for Room and Pillar mining.

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.

The main mining actions, activities and processes are listed below:

***UNLESS OTHERWISE STATED, THE INFORMATION CONTAINED BELOW REGARDING THE MINING DESIGN, METHODOLOGY AND INFRASTRUCTURE PROPOSED FOR THE MAMATWAN MANGANESE MINE, HAS BEEN EXTRACTED DIRECTLY FROM THE LATEST CONCEPT ENGINEERING STUDY (ROYAL HASKONINGDHV, 2013 – (Annexure 4 – Technical Information*).**

UNDERGROUND INFRASTRUCTURE

Primary access

The primary access is via a twin ramp system that is established from the highwall of a single, open, boxcut excavation. The ramp is inclined at 9.5 degrees and the portal position is approximately 20 metres below surface. The time to excavate and construct the boxcut is estimated to be 6 months and the total length of the ramp is approximately 680 metres. A conventional sink and line, 6 metre diameter, ventilation shaft has been provided for and which is planned to be constructed as a concurrent activity while the ramp system is developed. This depth of this shaft will be approximately 107 metres, with some 500 metres of off shaft development being carried out to reach the settler and dams positions and the main mining level breakaway position.

Logistics

All men, material and rock transport will be handled via the twin ramp system. The twin ramp system will be equipped with the appropriate electrical and water handling and pumping services. The dirty water pumping facility is based on the use of relay pump stations which are constructed as the ramp system is developed. Vehicle passing bays and truck loading bays have also been provided to expedite the overall development and to ensure that the truck hoisting capability is achieved by preventing congestion in the decline.

Service water

Mining service water is to be fed from a reservoir on surface, situated adjacent to the portal, and will be piped to the various working faces in a 150 NB steel column, fitted with pressure reducers where required. Spent service water, together with groundwater inflow will be picked up from the footwalls with submersible pumps, which will pump it to a nearby sump equipped with a vertical spindle pump, which in turn will deliver this dirty water to a main pump station. Four main pump stations are proposed throughout the life of the mine. Two settling ponds will be excavated on surface, so that duties can be alternated between them, to facilitate regular cleaning out of mud. Clarified water will be pumped back into the service water reservoir. Any excess of water from underground will be pumped to the process plant for make-up there. Should there however be a short fall, it would have to be made up from an external source such as the Vaal Gamagarra Water Scheme.

Potable water

Potable water lines will be installed from the reservoir on surface to the portal, and also to the underground area. There will be a main potable water column in the decline with branches and small diameter gate valves / tee pieces at regular intervals to provide drinking water and fire protection to each refuge bay.

Underground workshops

Underground service bays have been provided for, for daily servicing, maintenance and repairs of LHD's drill rigs and roof bolters. Articulated dump trucks will be serviced on surface. One of the bays will have an elevated ramp and another, a pit to access vehicles from underneath. A separate store, hydraulic service area, and tyre store has been provided.

A wash bay has been included, with oil trap, to meet the ISO 14001 requirements. All the necessary tools and equipment required for cleaning, lubricating, maintaining, servicing and minor repairs have been provided for, but no provision has been made for major overhauls since it is planned that these are to be carried out by the OEM. Diesel shall be delivered to the underground workings by fuel cassettes initially. In the pre-feasibility study, consideration should be given to pie fuel underground.

Electrical reticulation

The underground electrical reticulation will be supplied from the main substation which is located on surface; the reticulation will be at 11 kV and will be supplied via cabling. Underground load points will be equipped with mini-

substation units (MSU) suitably sized to cater for the specified electrical loads. The LV reticulation will be performed at 525 V and 400 V via motor control centres (MCC), gulley boxes and small power distribution boards.

PROCESS PLANT AND TAILINGS

The ore to be processed is from the Lower Manganese Ore body (LMO). The Upper and Middle Manganese Ore bodies in the lease area are not sufficiently well mineralized to be considered for exploitation. The sub-divisions of the LMO are divided into Z, M, C and N zones. Ore to be obtained from the the Z, M, C and N zones are considered to be of sufficient manganese grade to be direct shipping ore, without any upgrading being required.

Low phosphorus lump manganese ore will be stockpiled for sale to the market or it will be fed into a sinter plant. The generally required product is a lump with the size range of -75+6mm. The fraction finer than 6mm is generally screened at 1mm, with the -1 being discarded to a tailings dam and the -6+1 mm being stockpiled either for sale or as feed to a sinter plant.

A crushing and screening plant will be required to produce the -75+6mm product. The -6+1 mm product will be stockpiled. The screening plant could either make use of wet screening or dry screening.

Run-of-Mine ore will be delivered from underground and either fed directly onto the grizzly feeder ahead of the primary jaw crusher, or dumped onto the ROM stockpile ahead of the jaw crusher. During the times that ROM ore is not available from underground, ore can be reclaimed from the crusher stockpile with a front-end-loader and fed to the jaw crusher. Grizzly feeder oversize will be crushed by the jaw crusher. The grizzly feeder undersize will join the product from the jaw crusher and will be conveyed onto the secondary ore stockpile. This stockpile will have a live capacity equivalent to 12 hours of secondary crushing plant throughput, to take account of routine maintenance periods on the jaw crusher.

Ore will be withdrawn from the secondary crusher feed stockpile via vibrating feeders onto a conveyor and fed to the secondary screen feed bin. Ore will be withdrawn from the bin with a vibrating feeder and fed to a grizzly screen with a cut-point of 75 mm. 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 vibrating feeder and fed to the secondary crusher. Secondary 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 6 mm and 1.5 mm. 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 + 6 mm. The bottom deck oversize will be -6 + 1.5 mm and will be conveyed to the fines stockpile for either future sale or as possible sinter plant feed. Fines would be reclaimed from the fines stockpile with a front-end loader and loaded into road trucks for shipment.

The lump product will be conveyed to the lump product stockpile. Lump product will be withdrawn from this stockpile with vibrating feeders and fed to the rail load-out bin. Product from the load-out bin discharges into rail

trucks underneath the bin. Should the lump product stockpile reach its maximum capacity, lump can be moved out to the side of the stockpile with a front-end loader. This material would then be reclaimed with a front-end loader and fed back onto the load-out bin feed conveyor as and when required.

The bottom screen deck undersize (- 1.5 mm) is tailings. This stream will be cycloned in a dewatering cyclone, to ensure that coarse material does not enter the thickener. The cyclone overflow will gravitate to a high density thickener. It will be necessary to add flocculent to the thickener feed to assist in settling of the slimes particles. Thickener overflow will be returned to the plant water tank. The thickener underflow will join the cyclone underflow and be pumped to the tailings dam. The cyclone underflow could alternatively be deposited onto the fines stockpile, depending upon its manganese content.

It is not expected that any water will be recovered from the tailings dam penstock, except possibly during an exceptionally heavy rainstorm. Any penstock water recovered will pass to the return water dam and be pumped to the plant water tank at the beneficiation plant.

The plant is required to produce 1,000,000 tonnes per annum of lump product. The screening plant will also produce a -6+1 mm fines product and a -1 mm slimes fraction. Based on operating data from other plants the percentage of fines produced is expected to be between 14 and 21% of the ROM feed, with the higher numbers coming from an open pit operation in which the ore contains a significant quantity of clay minerals. A figure of 16% -6 mm material after crushing has been assumed. The ROM plant feed will therefore be 1,000,000 / (1 – 0.16) = 1,200,000 tonnes per annum. The slimes fraction reporting to the tailings dam will comprise 4% of the ROM feed and the fines fraction 12%. The water consumption in the plant will be minimal, apart from the water required for wet screening. It is expected that the slimes fraction of the ore will comprise 4% of the ROM plant feed. Based on a ROM plant feed rate of 1,200,000 mtpa, the tailings dam capacity will be required to be 48,000 tonnes per annum. It has been assumed that due to the low quantity of water associated with the tailings that is pumped in the tailings dam, that no water will be recovered from the tailings dam, except after heavy rainstorms. As no chemicals are being used in the processing plant, and no deleterious minerals are expected to dissolve into the plant water, a lining will not be required underneath the tailings dam.

SURFACE INFRASTRUCTURE

Roads

Existing access to the site and internal roads will have to be upgraded to support the additional traffic on the site. The internal haul roads proposed will be approximately 8m wide. The existing access road to the mine site is wide enough for access to the site. However, it is envisaged that approximately 3km of access road will need to be developed from the existing public road onto the mine site. An additional 2km (approximately) of roads will be required within the mine site.

Water Supply

Very limited groundwater inflow or surface run-off water is expected. Assuming that the inflow will only be enough to off-set losses to ventilation, air and entrapment in mined rock from underground, then the estimated make-up water requirement will be about 41,000 m³ per month for a 100 000 tpm mine. Bulk water supply from the existing 300mm Vaal Gamagarra Pipeline (which runs from the Vaal Gamagarra Scheme to Blackrock in the north) is envisaged. This pipeline runs adjacent to the proposed site at Mamatwan. Note that the capacity of this pipeline is currently fully allocated, but plans are being implemented to upgrade the line. Sedibeng Water (who manages the line) has been requested to add this project's requirements to their planning.

The breakdown of make-up water required for the mine is summarised in **Error! Reference source not found.** below.

Table 3: Breakdown of make-up water required for the mine

Total make-up water required			
ROM		tpm	100,000
Water in tailings		m³/month	4,000
Water in lump product	6%	m³/month	5,040
Water in fines product	8%	m³/month	960
Water in air,mud, rock u/g	17%	m³/month	17,000
Potable water		m³/month	1,400
Other	10%	m³/month	12,840
Total make-up water required		m³/month	41,240
Days per month			26
Hours per day			22
Flow rate	m³/h		72
Flow rate	l/s		20

Bulk supplies – Power

An estimated peak maximum demand of 4, 7 MVA has been calculated for the project. The bulk power supply will be provided by Eskom, at 11 kV, to the main surface substation from where it will be reticulated to the load centres. It is envisaged that the main reticulation voltage will be 11 kV with LV reticulation being at 525 V and 400 V. Eskom has been requested to provide an indicative cost for the bulk power supply as well as an indication of the availability of the required supply.

Surface infrastructure

Surface infrastructure proposed would comprise of the design and construction of all building structures, related earthworks and building services, electrical and mechanical and HVAC installations works. This would include *inter alia*:

- Site clearing and stormwater berms and trenches;
- Administration building and first aid;

- Change house and laundry;
- Lamp room, self-rescuer and proto room;
- Access control and security centre;
- TMM Maintenance workshop, services, lubrication, bays;
- Wash bay and oil skimmer;
- Bulk fuel storage area;
- Refuelling bay;
- Tyre storage, repair and pump area;
- LVD workshop;
- Fitting, electrical and boiler making workshop;
- Main stores and yard;
- Salvage yard;
- Fire and ambulance parking;
- External parking, shade ports and walkways;
- Electrical, water and sewage reticulation;
- Sewage treatment plant;
- Terraces, pavements, access, internal and haul roads;
- Perimeter and internal fencing; and
- Explosives off-loading, storage and distribution. Magazine.

PRODUCT LOGISTICS

Rail facilities and operations

For the purposes of this concept study, trade off options have not been considered. It is assumed that the mine will have its own dedicated rail siding for the purposes of loading manganese ore to transport to port for export.

The rail option considered for the study consists of a line that takes off the Middelplaats siding which is currently connected to Mamatwan mine. The siding goes over the farm Shirley 367 to enter the property of the mine in the southwest corner. This is the shortest option considered and was chosen to avoid the need to cross over any existing provincial roads. A loading loop will be provided with a rapid loading station on the north western side of the loop. A shunting locomotive will also not be required. The length of the rail loop will be approximately 9.7 km.

Rapid loading station

The rapid loading station consists of a feed conveyor from the product stockpile which feeds product into the silo, which in turn can load both train and road trucks. The silo capacity is 2,000 tonnes of manganese product. The silo discharges product into a loading flask designed to load rail trucks with a capacity of 63 tonnes each. The rapid loading station proposed will be able to load a train of 104 trucks in less than 3 hours. Alternatively 30 tonne road

trucks can be loaded via a radial door controlled chute from the bottom of the silo. Since this operation is manually controlled, the loading rate will obviously be a lot slower.

The discharging of the ore from the loading flask to the rail/road truck will be performed either automatically with sensors detecting the presence of the rail/road truck, or manually via the MMI screen.

A PLC control system will be installed at the loading point to provide monitoring and control of the loading. Silo level detection will be installed to prevent overfilling and emptying of the silo. Two loading flasks complete with load cells will be installed to accurately weigh and dispense the correct mass of product into the carriages and trucks. One flask will be for the train loading and the other will be for the truck loading. The desired load per carriage or truck will be controlled with the PLC via a user inputted value on the MMI. The control system will operate the loading and unloading of the load flask.

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)).

Maps annotating the spatial locality and aerial extent as well as the surface layout of the mine are attached in *Annexure 7: Maps and GIS*

2.5 Listed activities (in terms of the NEMA EIA regulations) which will be occurring within the proposed project.

The proposed development includes the following listed activities as stipulated in the EIA Regulations of 2010:

Table 4: Listed activities applied for in terms of the NEMA EIA regulations:

GOVERNMENT NOTICE	ACTIVITY	ACTIVITY DESCRIPTION
544	9	The construction of facilities or infrastructure exceeding 1 000 metres in length for the bulk transportation 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: • Such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or • Where such construction will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of a watercourse.
544	11	The construction of: i) Canals; ii) Channels; iii) Bridges; iv) Dams; v) Weirs;

GOVERNMENT NOTICE	ACTIVITY	ACTIVITY DESCRIPTION
		vi) Bulk storm water outlet structures; vii) Marinas; viii) Jetties exceeding 50 square metres in size; ix) Spillways exceeding 50 square meters in size; x) Buildings exceeding 50 square meters in size; or xi) Infrastructure or structures covering 50 square meters or more: where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse excluding where such construction will occur behind the development setback line.
544	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.
544	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from - A watercourse; - The sea; - The seashore; iv) The littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater - but excluding where such infilling, depositing, dredging, excavation, removal or moving ➢ Is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or ➢ Occurs behind the development setback line.
544	22	The construction of a road outside urban areas - a. With a road reserve wider than 13,5 meters; b. Where no reserve exists where the road is wider than 8 meters or c. 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.
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
544	37	The expansion of facilities or infrastructure for the bulk transportation of water, sewage or storm water where: a) The facility or infrastructure is expanded by more than 1 000 meters in length; or b) Where the throughput capacity of the facility or infrastructure will be increased by 10% or more – excluding where such expansion:

GOVERNMENT NOTICE	ACTIVITY	ACTIVITY DESCRIPTION
		1. Relates to transportation of water, sewage or storm water within a road reserve; or 2. Where such expansion will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of the watercourse.
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 Where no reserve exists, where the existing road is wider.
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.
545	20	Any activity which requires a mining right or renewal thereof as contemplated in section 22 of the Mining and Petroleum Resources Development Act, 2002 (Act 28 of 2002).

2.6 Indication of the phases (construction, operational, decommissioning) and estimated timeframes in relation to the implementation of these actions, activities or processes and infrastructure.

The phases and timeframes of the implementation of mining actions, activities and processes as well as infrastructure are set out in Table 5 below.

Table 5: The phases and timeframes of implementation of mining actions, activities and processes:

Phases and Activities, Actions and Processes:	Time frame:
Pre-construction Phase:	
Permitting applications and granting of; • Mining Right, • Environmental Authorisation ;and • Water Use license	**2 years**
Construction Phase:	
• Appointment of mining contractor; *Construction of Processing Plant:* • Site clearance; • Set up and construction of mining infrastructure	**Month 1-12** (The construction phase will commence upon granting of authorisation) (The construction of the processing plant will

i.e. • Site clearing and stormwater berms and trenches; • Administration building and first aid; • Change house and laundry; • Lamp room, self-rescuer and proto room; • Access control and security centre; • TMM Maintenance workshop, services, lubrication, bays; • Wash bay and oil skimmer; • Bulk fuel storage area; • Refuelling bay; • Tyre storage, repair and pump area; • LVD workshop; • Fitting, electrical and boiler making workshop; • Main stores and yard; • Salvage yard; • Fire truck and ambulance parking; • External parking, shade ports and walkways; • Electrical, water and sewage reticulation; • Sewage treatment plant; • Terraces, pavements, access, internal and haul roads; • Perimeter and internal fencing; and • Explosives off-loading, storage and distribution. Magazine.	take place in parallel with the build-up of ore production. The processing plant will be completed prior to the mining operation achieving its full production rate).
• Commissioning of the boxcut	**Month 1 – 3**
Operational Phase:	
(The operational phase will commence after completion of the boxcut, the life of mine is estimated to be 9 years)	**Month 4 to Year 9**
Primary Access: Two declines (6 m x 6m in section) will be developed through the over burden. (Average advance rate of 40 m per month)	**17 Months**
Secondary Access: On-reef development access concurrently with the development	**Month 21 to 24**

of two ore declines and two ledging drives, one on either side of the ore declines. All development ends will be 5 m in width and 5.3 m in height. It is assumed that these ends will advance together at 40 m per month. At the 40 m per month development rate, the reef access declines and ledging development will open up the first production section in approximately 4 months.	
Full production: The mine will attain its full production capacity during this phase. The subsequent two ore production sections will be available to produce by production month ten.	**Month 25 – Year 9**
Decommissioning Phase:	
Ramp down and closure	**From year 9** (Rehabilitation will run concurrently with the mining programme, however filling of the final void, reinstatement of dams and roads will commence towards the end of the life of mine).
Rehabilitation Phase:	**From year 9**

2.1 Confirmation if any other relevant information is attached as appendices.

The following Annexures with information relevant to the project are attached:

Annexure 1: Authority Correspondence

Annexure 2: Public Participation

Annexure 3: Specialist Reports

Annexure 4: Technical Information

Annexure 5: Impact Assessment and Mitigation Measures Report

Annexure 6: Environmental Management Programme

Annexure 7: Maps and GIS

Annexure 8: Financial Provision and Quantum Calculations

Annexure 9: Environmental Awareness Plan

3. The potential impacts

3.1 List of the potential impacts, on environmental aspects including the cultural / heritage 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)

Environmental aspects: Water Resources

Potential impacts – Surface Water:

- Increased water erosion on site area;
- Contamination of stormwater runoff due to spills and leaks of chemicals such as Hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles and other chemicals from construction activities e.g. paints;
- Contamination of surface water by seepage and effluent discharges;
- Altered drainage patterns and runoff flows;
- Subsidence, slumping and flooding of mining areas; and

Potential impacts – Groundwater:

- Contaminated runoff from concrete mixing and sediment release including spills and leaks of chemicals such as Hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles and other chemicals from construction activities e.g. paints, may lead to the infiltration of toxicants into the groundwater;
- Seepage from the stockpiles and from mining operations causes a contamination plume affecting the underground resources; and
- Impacts of dewatering on the groundwater aquifer.

Environmental aspects: Soils, Geology, Minerals and Land-use Capability

Potential impacts:

- Loss of topsoil;
- Compaction of soil;
- Impact of vegetation clearance on soil erosion and surface water runoff during the construction and operational phase;
- Soil contamination; and
- Subsidence, slumping and flooding of previously mined areas.

Environmental aspects: Sensitive Flora and Fauna:

Potential impacts:

- Destruction and removal of vegetation, including sensitive, endangered species;
- Destruction and or deterioration of biodiversity on the study and surrounding area;
- Fauna and flora habitat loss and disturbance;
- Disturbance of fauna; and
- Increase in alien invasive species.

Environmental aspects: Land Use and Capability:

Potential Impacts:

- Veld Fires; and
- Loss of land for other purposes; and
- Altered landforms due to construction of roads and excavation;

Environmental aspects: Socio-economic:

Potential impacts:

- Safety and injury or loss to workers or other persons on site;
- Increased risk to public health and safety;
- Damage to heritage sites;
- Pressure on local roads;
- Dangerous areas that pose health risks and possible loss of life;
- Trespassing of labour on other properties;
- Bush ablutions;
- Need for services e.g. water, electricity and sewerage systems;
- Positive - Development and upliftment of the surrounding communities and infrastructure;
- Positive - Development of the economic environment, by job provision and sourcing supplies for and from local residents and businesses; and
- Positive - Creation of medium to long term employment during all the phases of mining for local residents and skills transfer to unskilled and semi-skilled unemployed individuals.

Environmental aspects: Visual Character and 'Sense of Place':

Potential impacts:

- Impact on the visual character and or 'Sense of Place' of the area as a result of the establishment of mining infrastructure and related structures as well as waste dumps and stockpiles;

- Solid domestic waste;
- Building rubble;
- Visibility of mining site and activities; and
- Decreased aesthetic appeal of site.

Environmental aspects: Heritage and Cultural:

Potential impacts:

- Alteration of archaeological, historical and paleontological resources, including a graveyard on site containing five graves; a homestead older than 60 years and an area within 200m from the watercourse containing scattered stone tools from the LSA;

Environmental aspects: Noise, vibration and shock

Potential impacts:

- Disturbance due to vibrations caused by vehicles and blasting;
- Nuisance and health risks caused by an increase in the ambient noise level as a result of mine workings including: blasting activities; drilling, loading and hauling;
- Nuisance and health risks caused by an increase in the ambient noise level as a result of waste dumps when rocks are falling while being dumped;
- Nuisance and health risks caused by increased traffic on an adjacent to the study area including cars, busses and other heavy vehicles; and

Environmental aspects: Air Quality

Potential impacts:

- Windborne dust and vehicle fumes influencing the air quality;
- Dust settling on the surrounding area;
- Particulate Matter PM_{10}.

Environmental aspects: Traffic

Potential impacts:

- The change in the traffic patterns as a result of traffic entering and exiting the new mine on the surrounding road infrastructure and existing traffic.

For a detailed assessment refer to *Annexure 5*: Impact Assessment and Mitigation Measures Report

3.2 List of all potential cumulative environmental impacts.

Environmental Impacts from developments may be considered relatively insignificant when assessed in isolation; however they may potentially become very significant when assessed in the context of the impact of other developments nearby or in the general locality.

The following cumulative impacts have been identified during the undertaking of the specialists' studies:

- *Cumulative impacts on groundwater due to seepage from stockpiles and mining operations;*
- *Cumulative impact of hydrological modifications and stormwater;*
- *Cumulative impact of vegetation loss;*
- *Cumulative Impact of faunal habitat and displacement*
- *Cumulative Impact on natural migratory routes and faunal dispersal patterns;*
- *Positive cumulative impact on the surrounding communities, of socio-economic development including reducing unemployment rates and creating upliftment,*
- *Cumulative impact of decreasing air quality;*
- *Cumulative impact of increased traffic volumes as a result of more heavy vehicles making use of the roads in the immediate area;*

1. Cumulative impacts on groundwater from seepage of stockpiles and mining operations;

Source of impact:

Stockpiles of manganese ore for storage and general mining operations.

Description of impact:

Seepage from the stockpiles and from mining operations from fuels, oils and other chemicals, causes a contamination plume affecting the underground resources which in turn affects surface water resources.

Significance of impact:

The significance of the impact is high before and medium after mitigation.

Mitigation:

- Groundwater monitoring must be conducted;
- When chemicals e.g. paint, fuels and oils are handled during construction and maintenance impermeable material must be placed underneath to prevent spilling on the ground.

2. **Cumulative impact of Hydrological Modifications and Stormwater**

Source of the impact:

Hardened surfaces will impact negatively on the soils and vegetation of the area as the construction of impermeable layers on the surface will prevent infiltration and ultimately result in reduced seepage yields.

Description of the impact

Increased stormwater runoff with an associated increased erosion potential are also directly related to the expansion of hardened surface inside a catchment. Interventions and mechanisms can be included in the development to facilitate a higher percentage of infiltration (e.g. porous pavements).

Significance

The significance of the impact is expected to be of a medium significance without mitigation, this due to the removal of vegetation and the construction of hard surfaces. With mitigation the significance of the impact will be of a low significance even though the impact will not be reversible and is of a permanent nature.

Mitigation

- Interventions and mechanisms should be included in the proposed development to reduce the impact of stormwater on soil; and
- An ecologically sensitive stormwater management plan will be required to attenuate flood peak events and prevent excessive erosion.

3. **Cumulative impact of vegetation loss;**

Source of the impact:

Removal of vegetation during construction activities for access roads, buildings and other infrastructure. Stockpiles during the construction and operational phases.

Description of the impact:

Vegetation loss will result in decreased biodiversity on site including and fragmentation of habitat. Vegetation loss also increase soil erosion and increased stormwater runoff.

Significance of the impact:

Because the impact is of a permanent nature to a large extent it is of high significance before mitigation. However when mitigation measures are implemented, the impact will be medium after mitigation.

Mitigation:

- Removal of vegetation should be limited to the construction and mining area only;
- Where possible cleared areas should be rehabilitated as soon as possible during construction;
- Cleared areas should be reseeded with endemic, indigenous vegetation and the topsoil to be used should be declared weed free by a specialist;
- Replanted areas should be monitored until establishment took place. Should establishment not take place, the process should be repeated until establishment occur;

4. *Cumulative Impact of faunal habitat and displacement*

Source of the impact:

Destruction of faunal habitat and the displacement of species from their traditional home ranges during the construction phases of the proposed development.

Description of the impact

Faunal species could be displaced during the construction phase. This could result in higher than normal social, grazing and browsing pressures on areas that would otherwise not have these impacts. This could result in degraded vegetation cover from trampling, erosion, grazing or browsing and other forces.

Significance

The significance of the impact is expected to be of a medium significance without mitigation, this due to the displacement of faunal species from their habitats on site to allow for the building of the proposed development. With mitigation the significance of the impact will be reduced to that of a low significance.

Mitigation

- Minimising the loss of flora and fauna in areas that are not directly affected by the new development;
- Where possible trees to be removed should be transplanted at another suitable location;
- Reduce the levels of disturbance on the area during construction;
- All construction areas should be suitably top soiled and vegetated as soon as is possible after construction, preferably in phases during construction. Care should be taken that alien plant invasion is minimal. This must be monitored at regular intervals and removed and replaced with endemic, indigenous plants / trees where possible; and
- Disturbed surfaces to be rehabilitated must be ripped to a depth of 300mm, and the area must be backfilled with topsoil or overburden and vegetated as described above.

5. Cumulative Impact on natural migratory routes and faunal dispersal patterns

Source of the impact

The introduction of barriers such as walls, buildings, roads and other infrastructure during the operational phase of the proposed development would have an impact on the natural migratory routes and faunal dispersal patterns.

Description of the impact

Walls, buildings, roads and other infrastructure associated with the development may obstruct and constrict faunal dispersal and floral dispersal by limiting and funnelling natural dispersal patterns.

Significance

The significance of the impact is expected to be of a medium significance without mitigation, this due to the constriction of natural migratory routes and faunal dispersal patterns. With mitigation the significance of the impact will be reduced to that of a low significance.

Mitigation

- Sensitive areas e.g. the watercourse should be demarcated to prevent access during the mining phase;
- Reduce the levels of disturbance on areas indicated by the ECO as migratory routes along the Vlermuisleegte Watercourse;
- All construction areas should be suitably top soiled and vegetated as soon as is possible after construction;
- Disturbed surfaces to be rehabilitated must be ripped, and the area must be backfilled with topsoil or overburden;
- Use endemic, indigenous plants wherever possible in the landscaping of the property; and
- Try to maintain the natural vegetation in its original context as far as possible as this will enable species that are sensitive to transplanting to be maintained as well as their associated communities;

6. Positive cumulative impact on the surrounding communities, of socio-economic development including reducing unemployment rates and creating upliftment,

Source of impact:

Employment opportunities will be created if the proposed activity is approved to construct the mining facilities as well as during the operational phase when the actual mining will take place.

Description of impact:

- Job creation in an area where the main source of income is generated through primary activities e.g. farming;
- Creation of job opportunities during construction and operation for residents of the region;
- The provision of improved infrastructure and social upliftment, by creating short term employment over a period and skills transfer to unskilled and semi-skilled unemployed individuals;

- A project like this will create positive spin-offs in terms of job creation for at least the construction period of the project;
- Skills and training will be transferred to the local community and the greater area;

Significance:

The significance before mitigation is medium to high, and after mitigation very high.

Enhancement of positive impact measures:

- This economic opportunity should be structured in such a way that it can establish long-term sustainable economic growth both in terms of skilled and unskilled labour and further in terms of establishment of permanent business and economic growth opportunities in Hotazel and Kuruman. The proposed development aims at providing a Manganese mine where individuals will be able to work; and
- The Social and Labour plan attached to the report in *Annexure 3 – Specialists' Reports* should be implemented.

7. *Cumulative impact: decrease in air quality in the immediate surroundings of the mine;*

Source of impact:

Current sources of pollution (predominantly in the form of dust) in the vicinity of the site include the following:

- Dust from mining to the south east and north east of the site;
- The handling of ore, at these mines;
- Ore processing operations;
- Stockpiled materials and the mines;
- Disturbed land or land denuded of any vegetation;
- Vehicle movements on un-surfaced roads; and
- Disposal facilities.

Future sources of air pollution at the proposed mine will include:

- Materials handling operations with mining and predicted to result in significant fugitive dust emissions include the transfer of material by means of tipping, loading and off-loading trucks;
- Wind erosion from exposed areas – significant emissions arise due to the mechanical disturbance of granular material from open areas and storage piles;
- Primary crushing operations represent significant dust generating sources if uncontrolled;
- Particulate emissions will result from the entrainment of loose material from the paved road surface due to the vehicle traffic.

Description of impact:

Air quality monitoring has not been undertaken at this stage of the project as no mining activities has commenced on site. Sulphur Dioxide and other particulates represent pollutants that raise concerns in assessing the impact of the mines operations. The levels of these pollutants are also known to be elevated in other parts of South Africa and especially in Mpumalanga (also renowned for mining) as a result of mines as well as ESKOM electricity generation activities.

Mining activities in the general region as well as burning of wood and coal by the residents of many of the local communities are primary contributors to the air pollution experienced in the region.

The screening plant could either make use of wet screening or dry screening. It is however a Transnet requirement that ore transported by rail should be wet screened, since wet screened material contains less fine materials than dry screened products. Also the wet screening plant produces significantly less dust than a dry screening plant. No dust emanates from the wet screening operation, and the minimal dust coming from the crushers can be controlled by water sprays.

Significance of the impact:

The cumulative impact of PM_{10} concentrations has a significance of medium before mitigation and low after mitigation.

Mitigation:

- Air quality monitoring and modelling should for future activities concentrate on dust fallout and ambient PM_{10} and sulphur dioxide monitoring. Dust fallout monitoring will be undertaken to assess compliancy with dust fallout limits and will be reviewed annually. Monitoring will also be undertaken during the mining phase to assess sulphur dioxide compliancy with the ambient air quality guidelines and standards. The monitoring is conducted according to the main impact zone of the mine operations.
- Dust suppression activities such as water spraying are required during the construction and operational phase in order to minimise dust generation;

8. Cumulative impact: increased traffic volumes as a result of more heavy vehicles making use of the roads in the immediate area;

Source of the impact:

Traffic will increase in and around the proposed development. The increase of especially heavy vehicles movements surrounding the proposed land use locality, such as on Provincial roads which are in the vicinity of the mining complex and link up to the project area. In addition to this traffic within the mine area will also be a contributing fact towards cumulative impacts from an increase in traffic.

Description of the impact:

The proposed development entails the setup of mining activities as well as the construction of mine related infrastructure. Due to the nature of the activity it is likely that there will be a cumulative increase in vehicular traffic on roads adjacent to the proposed land use locality. The cumulative impacts emanating from the increase in traffic may become apparent during the construction phase of the manganese mine. The new permanent and temporary access roads if not surfaced, could contribute to dust impacts, spills and erosion and loss of soil resources.

Significance of impact:

The transport of materials, people and goods may present the only significant impact. The movement of vehicles on the local roads within the surrounding communities may result in damage to roads from movement of heavy vehicles. Despite the potential cumulative impacts from the traffic increase it is not anticipated that the impact will have a ranking higher than low for as long as the permanent or any non-surfaced roads are not in close proximity to the adjacent communities. As long as the roads are internalised, it is not anticipated that the cumulative impact of traffic will be significant.

Mitigation:

- Only main roads should be used;
- Where feasible vehicles should not operate on public roads during peak hours;
- Vehicles should adhere to the speed limit of the road;
- Heavy vehicles should always travel with their head lights switched on;
- Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the mine will be allowed;
- Limit the extent and degree of change to the biophysical and socio-economic environment; and
- Communicate with and acknowledge concerns of the I&APs and mitigate where possible.

For further detail refer to *Annexure 5*: Impact Assessment and Mitigation Measures Report

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).

ABA test results show that the formation of acid mine drainage from the ore body material is not likely. However, the exposed ore seams in the mined-out area will be subjected to oxidation and therefore it can be expected that some chemical reactions will occur during the early years after mine closure. Once the ore body seams are submerged below the recovering groundwater level oxidation and chemical reactions will largely stop. Leach testing show little sign of high element concentrations being present in the post-mining environment apart from manganese and to some extent iron and calcium concentrations. No contamination is expected from surface

sources under the assumption that proper rehabilitation of the ROM stockpile, ore stockpile and sinter plant product stockpile will remove any long term sources of pollution.

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.

The alternative land use would entail agriculture, where land for pastures for grazing of cattle, sheep and game.

4.2 List and description of all the main features and infrastructure related to the alternative land uses or developments.

Animal husbandry and fodder support for the cattle and sheep will require the following components to be constructed:

- Dip tanks;
- Spray races;
- Chaff cutters;
- Kraals, Crushes and Loading ramps;
- Fodder barn;
- Borehole (Well) equipping support for abstraction of water; and
- Road infrastructure to access the cultivated fields.

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.

Annexure 7 – Maps and GIS

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.

Feature / Infrastructure	Potential Impacts
Livestock and Game Farming	Increased pressure on veld resources Over grazing Loss of soils through incorrect management Increased income and associated socio-economic benefits Increased pressure on water resources
Roads	Dust generation
Water Supply	Increased pressure on water resources
Agriculture	Alteration of natural drainage patterns Depletion of biodiversity Surface and/or groundwater pollution through the use of fertilisers Dust generation from exposed areas Erosion Increased income and associated socio-economic benefits

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)

The potential negative socio-economic impacts include the following:

1. Visual impacts of the ore stockpiles and infrastructure and the possible impact on property values due to visual disturbance;
2. Security concerns;
3. Dust and noise impacts;

4. Inward migration;
5. Blasting hazards; and
6. Project related road use and traffic.

The potential positive socio-economic impacts include the following:

A project like this will create positive spin-offs in terms of job creation not only during the construction period of the project but also during the operational phase. This economic opportunity must also be structured in such a way that it can establish long-term sustainable economic growth both in terms of skilled and unskilled labour and further in terms of establishment of permanent business and economic growth opportunities in the immediate area.

The proposed Mamatwan Manganese Mine will have a significant positive impact on the baseline socio-economic conditions of the local communities, since unemployment is a major problem within the districts. The mine will create several employment opportunities and preference will be given to the locally unemployed wherever possible. Employment should be sourced from the local community and the Industrial Policy Action Plan (IPAP) be implemented. Employment will be created in phases including the construction, commissioning, production (operational), decommissioning and rehabilitation phases. During these phases, employees will mainly be recruited from the Joe Morolong Local Municipality (mainly Hotazel) then the District Management Area, in general and thereafter the rest of the province. About 300 – 500 people will be employed during the construction phase. The mine shall procure goods and services from the HDI Service Providers Database as provided by the Joe Morelong Local Municipality.

The impact of this mine can potentially be very negative if labour is sourced from elsewhere and the local residents are excluded from economic benefit to be gained from the construction and operational phase of the mine. Certainly, some skilled labour will have to be imported from other areas but unskilled labour is available, and if work is given to these people it will have a great benefit and have a very positive significant impact on the region as a whole.

This job creation will not have a direct or indirect effect on other parties' land use activities.

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).

Apart from the heritage features described below, no other culturally sensitive artefacts are recorded on site. Therefore it is highly unlikely that any sensitive cultural aspects of any person on the property or on adjacent properties will be affected during the construction and operation of the mine.

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).

A number of archaeological sites / resources of significance were identified across the study area. These include five marked graves, a homestead dating to the Historical Period, and scattered stone tools of the Late Stone Age (LSA).

There is also a possibility that the mining may uncover buried archaeological resources or burials. However no heritage features have been recorded on the site that is to be mined. Therefore the likelihood that any sensitive heritage aspects will be affected during the construction and operation of the mine is low, provided that the mitigation measures are implemented.

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.

Due to the locality of the mine there will be no direct negative impacts on any affected persons arising from the mining activities, actions or processes.

6.4.1 The amount of the quantified potential impact on property or infrastructural assets.

There will be no direct negative impacts on property or infrastructural assets of any of the neighbours, provided that mitigation measures are implemented.

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.

No direct negative impacts on commercial, economic or business activity as a result of the Mine is anticipated, due to the fact that there are other similar mining activities in the region.

6.4.3 The sum of the amounts, referred to in paragraphs 6.6.1 and 6.6.2 above.

None.

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 section of the guideline posted on the official website of the Department)

<u>Potential impacts related to surface water aspect:</u>

- Increased water erosion on site area;
- Contamination of stormwater runoff due to spills and leaks of chemicals such as fuel and oils;
- Contamination of stormwater runoff due to suspended solids;
- Contamination of surface water by seepage and effluent discharges;

- Altered drainage patterns and runoff flows; and
- Subsidence, slumping and flooding of mining areas.

Potential impacts related to groundwater aspect:

- Contaminated runoff from concrete mixing and sediment release including spills and leaks of chemicals such as Hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles and other chemicals from construction activities e.g. paints, may lead to the infiltration of toxicants into the groundwater;
- Seepage from the stockpiles and from mining operations causes a contamination plume affecting the underground resources; and
- Impacts of dewatering on the groundwater aquifer.

Potential impacts related to air quality & noise aspects

- Windborne dust and vehicle fumes influencing the air quality;
- Dust settling on the surrounding area;
- Disturbance due to noise;
- Disturbance due to vibrations caused by vehicles.

Potential impacts related to soils and geological aspect:

- Ground surface disturbance;
- Loss of topsoil;
- Compaction of soil;
- Increased soil erosion;
- Soil pollution; and
- Subsidence, slumping and flooding of previously mined areas.

Potential impacts related to fauna and flora aspects

- Destruction and removal of vegetation, including sensitive, endangered species;
- Destruction and or deterioration of biodiversity on the study and surrounding area;
- Fauna and flora habitat loss and disturbance;
- Disturbance of fauna; and
- Increase in alien invasive species.

Potential impacts related to aesthetic aspects

- Solid domestic waste;
- Building rubble;

- Visibility of mining site and activities;
- Decreased aesthetic appeal and 'Sense of Place' of site.

Potential impacts related to land use and capability aspect:

- Veld Fires;
- Loss of land for other purposes;
- Altered landforms due to construction of roads and excavation.

Potential impacts related to social aspects

- Safety and injury or loss to workers or other persons on site;
- Increased risk to public health and safety;
- Damage to heritage sites;
- Pressure on local roads;
- Dangerous areas that pose health risks and possible loss of life;
- Spreading of diseases such as diarrhoea, HIV and TB;
- Trespassing of labour on other properties;
- Bush ablutions;
- Need for services e.g. water, electricity and sewerage systems; and
- Job creation – Positive.

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).

The EIA methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

The criteria for the description and assessment of environmental impacts were drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989). Although the ECA EIA Regulations have been repealed, the Guideline Document still provides good guidance for significance determination.

The level of detail as depicted in the EIA regulations were fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was

assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. The impact assessment criteria used to determine the impact of the proposed development are as follows:

- Nature of the impact;
- The source of the impact;
- Affected Stakeholders;
- Extent - The physical and spatial scale of the impact;
- Duration - The lifetime of the impact, that is measured in relation to the lifetime of the proposed development;
- Intensity - The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself;
- Probability - This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time;
- Mitigation - The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.
- Determination of Significance – Without Mitigation. Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required.
- Determination of Significance – With Mitigation. Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the identified mitigation measures.
- All identified impacts will be assessed in accordance with the abovementioned criteria and the extended criteria.

Determination of significance of impacts

Significance is determined through a synthesis of impacts characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national, global whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact rating system

Impact assessment must take cognisance of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- Planning;
- Construction;
- Operational; and
- Decommissioning.

Where necessary the proposal for mitigation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

Assessment of Biophysical and Cumulative Impacts

The criteria for the description and assessment of environmental impacts were drawn from the EIA Regulations and in terms of the Environmental Conservation Act, 1989 (Act No 73 of 1989) [ECA]. Although the ECA EIA Regulations have been repealed the Guideline Document still provides good guidance for significance determination.

Activities within the framework of the proposed development and their respective construction and operational phases, give rise to certain impacts. For the purpose of assessing these impacts, the project has been divided into two phases from which impacting activities can be identified, namely:

a) *Construction phase:*

All the construction related activities on site, until the contractor leaves the site.

b) *Operational phase:*

All activities, including the operation and maintenance of the proposed development.

The activities arising from each of these phases have been included in the tables. This is to identify activities that require certain environmental management actions to mitigate the impacts arising from them. The criteria against which the activities were assessed are given in the next section.

Assessment criteria

The assessment of the impacts has been conducted according to a synthesis of criteria required by the integrated environmental management procedure.

Extent

The physical and spatial scale of the impact is classified as:

a. Footprint

The impacted area extends only as far as the activity, such as footprint occurring within the total site area.

b. Site

The impact could affect the whole, or a significant portion of the site.

c. Regional

The impact could affect the area including the neighbouring properties, the transport routes and the adjoining towns.

d. National

The impact could have an effect that expands throughout the country (South Africa).

e. International

Where the impact has international ramifications that extent beyond the boundaries of South Africa.

Duration

The lifetime of the impact, that is measured in relation to the lifetime of the proposed development.

a. Short term

The impact would either disappear with mitigation or will be mitigated through natural processes in a period shorter than that of the construction phase.

b. Short to Medium term

The impact will be relevant through to the end of the construction phase.

c. Medium term

The impact will last up to the end of the development phases, where after it will be entirely negated.

d. Long term

The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter.

e. Permanent

This is the only class of impact, which will be non-transitory. Mitigation either by man-made or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Intensity

The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. The intensity is rated as:

a. Low

The impact alters the affected environment in such a way that the natural processes or functions are not affected.

b. Medium

The affected environment is altered, but functions and processes continue, albeit in a modified way.

c. High

Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Probability

This describes the likelihood of the impacts actually occurring. The impact may occur for any length during the life cycle of the activity, and not at any given time. The classes are rated as follows:

- Impossible

The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0%).

- Possible

The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25%.

- Likely

There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50%.

- Highly likely

It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75%.

- Definite

The impacts will take place regardless of any provisional plans, and or mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100%.

Mitigation

The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.

Determination of significance – Without Mitigation

Significance is determined through a synthesis of impacts as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, significance is noted as "positive". Significance is rated on the following scale:

a. No significance

The impact is not substantial and does not require any mitigation action.

b. Low

The impact is of little importance, but may require limited mitigation.

c. Medium

The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.

d. High

The impact is of major importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

Determination of significance – With Mitigation

Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. Significance with mitigation is rated on the following scale:

- No significance

The impact will be mitigated to the point where it is regarded as insubstantial.

- Low

The impact will be mitigated to the point where it is of limited importance.

- Low to Medium

The impact is of importance however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.

- Medium

Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.

- Medium to High

The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.

- High

The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

Assessment weighting

Each aspect within the impact description was assigned a series of quantitative criteria. Such criteria are likely to differ during the different stages of the project's life cycle. In order to establish a defined base upon which it becomes feasible to make an informed decision, it is necessary to weigh and rank all criteria.

Ranking, Weighting and Scaling

For each impact under scrutiny, a scale weighting factor (WF) is attached to each respective impact (refer to Figure 12: Description of biophysical assessment parameters with its respective weighting). The purpose of assigning such weight serve to highlight those aspects considered most critical to the various stakeholders and ensure that each specialist's element of bias is taken into account. The weighting factor also provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspects criteria.

Simply, such a weighting factor is indicative of the importance of the impact in terms of the potential effect that it could have on the surrounding environment. Therefore, the aspects considered to have a relatively high value will score a relatively higher weighting than that which is of lower importance.

Extent	Duration	Intensity	Probability	Weighting Factor (WF)	Significance Rating (SR)	Mitigation Efficiency (ME)	Significance Following Mitigation (SFM)
Footprint 1	Short term 1	Low 1	Probable 1	Low 1	Low 0-19	High 0,2	Low 0-19
Site 2	Short to medium 2		Possible 2	Low to medium 2	Low to medium 20-39	Medium to high 0,4	Low to medium 20-39
Regional 3	Medium term 3	Medium 3	Likely 3	Medium 3	Medium 40-59	Medium 0,6	Medium 40-59
National 4	Long term 4		Highly Likely 4	Medium to high 4	Medium to high 60-79	Low to medium 0,8	Medium to high 60-79
International 5	Permanent 5	High 5	Definite 5	High 5	High 80-100	Low 1,0	High 80-100

Figure 12: Description of biophysical assessment parameters with its respective weighting

Identifying the Potential Impacts Without Mitigation (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

Identifying the Potential Impacts With Measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it was necessary to re-evaluate the impact.

a. Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact.

Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2:

Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency

or WM = WOM x ME

b. Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account.

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SURFACE WATER ASPECT								
Increased water erosion on site area	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Power supply ❖ Building footprint Storage of chemicals and fuel ❖ **Operational phase: Transport and Stockpiling the Manganese Material;** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	3	4	24	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SURFACE WATER ASPECT								
Contamination of stormwater runoff due to spills and leaks of chemicals such as fuel and oils	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Storage of chemicals and fuel	3	5	3	5	48	M	L
Contamination of stormwater runoff due to suspended solids	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty)	2	3	3	4	24	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SURFACE WATER ASPECT								
Contamination of stormwater runoff due to suspended solids	**Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning of temporary buildings ❖ Reseeding/planting of disturbed areas ❖ Water quality treatment ❖ Fencing dangerous areas	2	3	3	4	24	L	L
Contamination of surface water by seepage and effluent discharges	**Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Power supply ❖ Building footprint Storage of chemicals and fuel ❖ **Operational phase: Transport and Stockpiling the Manganese Material;** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning of temporary buildings	3	5	3	5	48	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SURFACE WATER ASPECT								
Subsidence, slumping and flooding of mining areas	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Power supply ❖ Building footprint Storage of chemicals and fuel ❖ **Operational phase: Transport and Stockpiling the Manganese Material;** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning of temporary buildings ❖ Reseeding/planting of disturbed areas	2	5	5	3	65	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO GROUND WATER ASPECT								
Dewatering of the groundwater aquifer	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Storage of chemicals and fuel **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Rail transport (laden) ❖ Rail transport (empty) ❖ Servicing of transport vehicles and mining equipment ❖ Storage of vehicles	3	4	1	3	33	M	M

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO GROUND WATER ASPECT								
Contamination of groundwater resources from fuels, oils and other chemicals Groundwater contamination from seepage	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Storage of chemicals and fuel **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Rail transport (laden) ❖ Rail transport (empty) ❖ Servicing of transport vehicles and mining equipment. ❖ Storage of vehicles **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty)	3	5	3	5	48	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO GROUND WATER ASPECT								
Contamination of groundwater resources from fuels, oils and other chemicals Groundwater contamination from seepage	**Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	3	5	3	5	48	M	L
ISSUES RELATED TO AIR QUALITY & NOISE ASPECTS								
Windborne dust and vehicle fumes influencing the air quality.	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Storage of chemicals and fuel **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles ❖ Servicing of transport vehicles and mining equipment.	3	4	3	4	28	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO AIR QUALITY & NOISE ASPECTS								
Windborne dust and vehicle fumes influencing the air quality.	**Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas ❖ Water quality treatment ❖ Fencing dangerous areas ❖ Monitoring of seepage	3	4	3	4	28	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO AIR QUALITY & NOISE ASPECTS								
Dust settling on the surrounding area	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services ❖ Storage of chemicals and fuel ❖ Power supply ❖ Building footprint. **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Servicing of transport vehicles and mining equipment. ❖ Storage of vehicles **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** Decommissioning and dismantling of temporary buildings	3	4	3	4	28	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO AIR QUALITY & NOISE ASPECTS								
Disturbance due to noise Disturbance due to vibrations caused by vehicles	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" ❖ Operational phase: Workshops, Stores and General Office Environments: ❖ Maintenance of on-site office /stores and roads ❖ Operation of workshops, stores and General office environments **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Rail transport (laden) ❖ Rail transport (empty) ❖ Servicing of transport vehicles and mining equipment. **Operational phase:** ❖ Manganese material crushing ❖ Loading the Machinery ❖ Operational phase: Transport of the Final product to the Market: ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** Decommissioning and dismantling of temporary buildings	3	3	1	5	24	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOILS AND GEOLOGICAL ASPECT								
Ground surface disturbance	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply. ❖ Building footprint. **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** ❖ Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	3	4	3	4	28	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOILS AND GEOLOGICAL ASPECT								
Loss of topsoil and increased erosion	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply. ❖ Building footprint. **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase: Transport of the Final product to the Market:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	3	4	24	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOILS AND GEOLOGICAL ASPECT								
Compaction of soil	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply. ❖ Building footprint. **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase: Transport of the Final product to the Market:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	5	4	42	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOILS AND GEOLOGICAL ASPECT								
Soil pollution	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply. ❖ Building footprint. **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase: Transport of the Final product to the Market:** ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings	2	3	5	4	42	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOILS AND GEOLOGICAL ASPECT								
Subsidence, slumping and flooding of previously mined areas	**Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas ❖ Water quality treatment ❖ Fencing dangerous areas	2	5	5	3	65	M	L
ISSUES RELATED TO FAUNA AND FLORA ASPECTS								
Removal of vegetation	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply	2	5	5	5	68	M	L
Reduction in biodiversity on site	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply.	2	5	5	5	68	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO FAUNA AND FLORA ASPECTS								
Fauna and flora habitat loss and disturbance	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply.	2	5	3	5	30	M	L
Disturbance of animals	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply.	2	5	5	5	68	M	L
Increase of invasive species	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Maintenance of on-site office /stores and roads ❖ Water supply and sewage services. ❖ Power supply. **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	3	4	3	4	42		L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO AESTHETIC ASPECTS								
Solid domestic waste	**Operational phase: Workshops, Stores and General Office Environments:** ❖ Operation of workshops, stores and general office environments ❖ Storage of chemicals and fuel	4	4	1	3	27	L	M
Building rubble	**Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings Reseeding/planting of disturbed areas	0	2	1	2	6	L	L
Visibility of mining site and activities	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden"	4	3	2	3	27	L	L
Decreased aesthetic appeal of site	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden"	4	3	2	3	27	L	L
ISSUES RELATED TO LAND USE AND CAPABILITY ASPECT								
Veld Fires	**Operational phase: Workshops, Stores and General Office Environments:** ❖ Operation of workshops, stores and general office environments ❖ Storage of chemicals and fuel ❖ Road maintenance Servicing of transport vehicles and mining equipment. ❖ Dirty road transport **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	6	3	2	3	33	M	M

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO LAND USE AND CAPABILITY ASPECT								
Loss of land for other purposes	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden"	2	3	1	3	18	L	L
Altered landforms due to construction of roads and excavation	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Workshops, Stores and General Office Environments:** ❖ Road maintenance ❖ Dirt road transport **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	1	3	18	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Safety and injury or loss to workers or other persons on site	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Loading of manganese on trucks; ❖ Stockpiling Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles ❖ Servicing of transport and mining vehicles **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles ❖ Servicing of transport vehicles and mining equipment. **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	5	3	65	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Increased risk to public health and safety	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Loading of manganese on trucks; ❖ Stockpiling Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles ❖ Servicing of transport and mining vehicles **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) ❖ Storage of vehicles ❖ Servicing of transport vehicles and mining equipment. **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	1	3	18	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Damage to heritage sites	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	5	5	3	75	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Pressure on local roads	**Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	2	2	18	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
Dangerous areas that pose health risks and possible loss of life (e.g. pits, etc.)	**Operational phase:** ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Transport and Stockpiling the Manganese Material; ❖ Transport of the Final product to the Market: **Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	4	5	3	70	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
Spreading of diseases such as diarrhoea, HIV and TB	**Operational phase:** ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Transport and Stockpiling the Manganese Material; ❖ Transport of the Final product to the Market: **Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	4	5	3	70	M	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Trespassing of labour on other properties	**Operational phase:** ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Transport and Stockpiling the Manganese Material; ❖ Transport of the Final product to the Market: **Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	2	3	2	3	20	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Bush ablutions	**Operational phase:** ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Transport and Stockpiling the Manganese Material; ❖ Transport of the Final product to the Market: **Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings Reseeding/planting of disturbed areas:	2	3	2	3	20	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Need for services e.g. water, electricity and sewerage systems	**Operational phase:** ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Transport and Stockpiling the Manganese Material; ❖ Transport of the Final product to the Market: **Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings Reseeding/planting of disturbed areas	2	3	2	5	24	L	L

Table 6: Impact Assessment Table With Concomitant Impact Rating

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION						
		Extent	Duration	Intensity	Probability	TOTAL	Impact	Cumulative Impact
ISSUES RELATED TO SOCIAL ASPECTS								
Job creation - ***Positive***	**Operational phase:** ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Overburden Excavation and Topsoil Stockpiling Phase; ❖ Transport and Stockpiling the Manganese Material; ❖ Transport of the Final product to the Market: **Operational phase: Overburden Excavation and Topsoil Stockpiling Phase:** ❖ Stripping, storing and replacement of top-soil ❖ Stripping, storing and replacement of soil "overburden" **Operational phase: Transport and Stockpiling the Manganese Material:** ❖ Stockpiling ❖ Road maintenance ❖ Dirt road transport (laden) ❖ Dirt road transport (empty) **Operational phase:** Storing the final product **Operational phase: Transport of the Final product to the Market:** ❖ Stockpiling ❖ Road maintenance ❖ Rail transport (laden) ❖ Rail transport (empty) **Mine Closure and Post-Operational Waste Management Phase:** ❖ Decommissioning of roads ❖ Decommissioning and dismantling of temporary buildings ❖ Reseeding/planting of disturbed areas	3	3	5	5	80	H	M

For further impact rating with mitigation measures refer to *Annexure 5:* Impact Assessment and Mitigation Measures Repo

7.3. Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the potential impacts rated.

Construction Phase: - Timeframe: 12 months

(The construction phase will commence upon granting of authorisation)

(The construction of the processing plant will take place in parallel with the build-up of ore production. The processing plant will be completed prior to the mining operation achieving its full production rate).

- Appointment of mining contractor;

Construction Phase – Processing Plant:

- Site clearance;
- Set up and construction of mining infrastructure i.e.
- Site clearing and stormwater berms and trenches;
- Administration building and first aid;
- Change house and laundry;
- Lamp room, self-rescuer and proto room;
- Access control and security centre;
- TMM Maintenance workshop, services, lubrication, bays;
- Wash bay and oil skimmer;
- Bulk fuel storage area;
- Refuelling bay;
- Tyre storage, repair and pump area;
- LVD workshop;
- Fitting, electrical and boiler making workshop;
- Main stores and yard;
- Salvage yard;
- Fire and ambulance parking;
- External parking, shade ports and walkways;
- Electrical, water and sewage reticulation;
- Sewage treatment plant;
- Terraces, pavements, access, internal and haul roads;
- Perimeter and internal fencing; and
- Explosives off-loading, storage and distribution magazine.

- **Commissioning of the boxcut – Timeframe: Month 1-3**

Operational Phase: - Timeframe: Month 4 to Year 9

(The operational phase will commence after completion of the boxcut, the life of mine is estimated to be 9 years)

Primary Access: - Timeframe: 17 Months

Two declines (6 m x 6m in section) will be developed through the over burden. (Average advance rate of 40 m per month)

Secondary Access: - Timeframe: Month 21 to24

On-reef development access concurrently with the development of two ore declines and two ledging drives, one on either side of the ore declines. All development ends will be 5 m in width and 5.3 m in height. It is assumed that these ends will advance together at 40 m per month.

At the 40 m per month development rate, the reef access declines and ledging development will open up the first production section in approximately **4 months**.

Full production: - Timeframe: Month 25 – Year 9

The mine will attain its full production capacity during this phase. The subsequent two ore production sections will be available to produce by production **month ten**.

Decommissioning Phase: - From Year 9

- **Ramp down and closure**

Rehabilitation Phase:

(Rehabilitation will run concurrently with the mining programme, however filling of the final void, reinstatement of dams and roads will commence towards the end of the life of mine).

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)

Agriculture and grazing is the only alternative land use that could be impacted upon. No other land use was identified that could be affected.

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)

No comparative land use assessment was conducted for the report. However the decision to undertake mining as opposed to leaving the area as is for agricultural purposes was informed by detailed cost benefit analysis as well as an assessment of the economic and financial viability of the proposed mining.

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)

- Impacts on Water Resources

Groundwater contamination of seepage from stockpiles and other construction and operational related contaminants.

- Impact on Change in Surface Cover

Portions of the vegetated surface cover will be cleared to make way for the proposed development. The exposed soil and the presence of construction equipment, material stockpiles, site offices and construction camps will contrast in colour and form with the receiving environment. The moderate visual absorption capacity of the receiving environment will leave the construction activity exposed. The landscape impact will be moderate.

- Impacts Relating to Disturbance of sensitive Flora

Human encroachment and movement could disturb the occurrence of flora and fauna on the site.

The *Acacia erioloba, Acacia heamoxtylon* and *Boscia albitrunca* trees occurring on the study area are endangered species. These trees are considered important and nationally protected under the National Forestry Act, 1998 (Act No. 30 of 1998). A tree removal license should be applied for at the department of Agriculture, Forestry and Fisheries, for the protected species should the proposed project be authorised.

- Impacts of potential Veld Fires

There is a risk of veld fires during all phases of development. The area has low rainfall and vegetation is dry therefore the risk is high. However with the implementation of mitigation measures it becomes a low risk.

- Spreading of Diseases such as Diarrhoea, HIV and TB

During all phases of mining there is a risk of diseases spreading.

- Impact on Heritage Features

The graves are located within a fenced graveyard, in close proximity of the homestead. These are family graves of the owner of the Remaining Extent of the Farm Mamatwan 331. The oldest grave dates to 1953 and the most recent one to 2000. Should these graves be impacted on or would other graves be discovered during construction and operational activities the following will apply: The National Heritage Resources Act, 1999 (Act No 25 of 1999) and the Human Tissues Act, 1983 (Act No 65 of 1983) protect graves older than 60 years. Graves younger than 60 years, are protected under the Human Tissue Act, 1983 (Act No. 65 of 1983) and fall under Section 2 (1) of the Removal of graves and Dead Bodies Ordinance, 1925 (Ordinance No. 7 of 1925). The exhumation of graves falls under the jurisdiction of the National Department of Health and the relevant Provincial Department of Health. Exhumation permission must also be obtained from the relevant local or regional council were graves are located, and from the relevant regional and local council to where the grave will be relocated.

The homestead was built in 1922, therefore older than 60 years and thus protected under the National Heritage and Resources Act, 1999 (Act No. 25 of 1999). According to the landowner his ancestors were of the first people to move to the specific area. Such information might be useful in terms of a regional context. Adding to this is the fact that the family graves are located in close proximity to the original homestead. The vineyard was established in 1930. The other buildings on the property which dated to the Historical Period were destroyed by wind storms and demolished by the owner a long time ago.

The scattered stone tools of the Late Stone Age (LSA) were observed within a 200 m radius along the riverbed on the Remaining Extent. This specific area is important and the area should not be disturbed by any activities.

- Impact on Employment:

The potential positive socio-economic impacts include the following:

A project like this will create positive spin-offs in terms of job creation not only during the construction period of the project but also during the operational phase. This economic opportunity must also be structured in such a way that it can establish long-term sustainable economic growth both in terms of skilled and unskilled labour and further in terms of establishment of permanent business and economic growth opportunities in the immediate area.

The proposed Mamatwan Manganese Mine will have a significant positive impact on the baseline socio-economic conditions of the local communities, since unemployment is a major problem within the districts. The mine will create several employment opportunities and preference will be given to the locally unemployed wherever possible. Employment should be sourced from the local community and the Industrial Policy Action Plan (IPAP) be implemented. Employment will be created in phases including the construction, commissioning, production

(operational), decommissioning and rehabilitation phases. During these phases, employees will mainly be recruited from the Joe Morolong Local Municipality (mainly Hotazel) then the District Management Area, in general and thereafter the rest of the province. About 300 – 500 people will be employed during the construction phase. The mine shall procure goods and services from the HDI Service Providers Database as provided by the Joe Morelong Local Municipality.

The impact of this mine can potentially be very negative if labour is sourced from elsewhere and the local residents are excluded from economic benefit to be gained from the construction and operational phase of the mine. Certainly, some skilled labour will have to be imported from other areas but unskilled labour is available, and if work is given to these people it will have a great benefit and have a very positive significant impact on the region as a whole.

- Reduction in Air Quality:

For more in-depth detail refer to *Annexure 5*: Impact Assessment and Mitigation Measures Report

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)

Public Participation is the involvement of all parties who are either potentially interested or affected by the proposed development. The principle objective of public participation is to inform and enrich decision-making. This is also its key role in the Environmental Impact Assessment (EIA) process. Generally, the following information is included:

Interested and Affected parties (I&APs) representing the following sectors of society have been identified (refer to *Annexure 2* for a complete I&AP distribution list):

- National, provincial and local government;
- Agriculture, including local landowners;
- Community Based Organisations;
- Non-Governmental Organisations;
- Water bodies;
- Tourism;
- Industry and mining;
- Commerce;

- Historically disadvantaged groups, including women, youth and the disabled;
- Research; and
- Other stakeholders.

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)

Due to the fact that a joint process is being undertaken in terms of 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 (Act No. 36 of 2008) ("NWA"), consultation on the project has been extensive.

The following provides an overview of the tasks undertaken for the PPP to date. All PPP undertaken is in accordance with the requirements of the MPRDA requirements and EIA Regulations (2010).

The PPP tasks conducted for the proposed new plant development project to date includes:

IDENTIFICATION OF KEY INTERESTED AND AFFECTED PARTIES (AFFECTED AND ADJACENT LANDOWNERS) AND OTHER STAKEHOLDERS (ORGANS OF STATE AND OTHER PARTIES)

Public Participation is the involvement of all parties who are either potentially interested and or affected by the proposed development. The principle objective of public participation is to inform and enrich decision-making. This is also its key role in this Environmental Impact Assessment (EIA) process.
Interested and Affected parties (I&APs) representing the following sectors of society has been identified:

- National, provincial and local government;
- Agriculture, including local landowners (affected and adjacent);
- Community Based Organisations;
- Non-Governmental Organisations;
- Water bodies;
- Tourism;
- Industry and mining;
- Commerce; and
- Other stakeholders.

FORMAL NOTIFICATION OF THE APPLICATION TO INTERESTED AND AFFECTED PARTIES (INCLUDING ALL AFFECTED AND ADJACENT LANDOWNERS) AND OTHER STAKEHOLDERS

The project was announced as follows:

- Newspaper advertisement

Publication of media advertisements (Afrikaans and English) in the Kalahari Bulletin Newspaper on 01 August 2013. Refer to *Annexure 2* for proof of placement of the newspaper advert.

- Site notice placement

In order to inform surrounding communities, affected and adjacent landowners of the proposed development, site notices were erected on site and at visible locations close to the site. Refer to *Annexure 2* for proof of site notice placement.

- Written notification

I&AP's and other key stakeholders, who included the above-mentioned sectors, were directly informed of the proposed development by e-mail on 30 July 2013. The Background Information Document (BID) and Registration and Comment sheets were also supplied to all parties. I&APs were given 30 days to comment and / or raise issues of concern regarding the proposed development. The commenting period expired on the 5th of September 2013. Refer to *Annexure 2* for a copy of the BID and proof of email notification.

CONSULTATION AND CORRESPONDENCE WITH I&AP'S AND STAKEHOLDERS

All I&AP registrations and comments that have been received from stakeholders is formally recorded in the Comments and Responses Report. Refer to *Annexure 2* for comments and responses.

All documents released to date are placed on the ENVASS website (www. envass.co.za) for review and download. For more details pertaining to the engagement process undertaken refer to *Annexure 2*: Public Participation

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)

I&APs had the opportunity to raise issues either in writing, during the initial announcement phase of the project as well as the during the consultation process that was being undertaken for the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA") and The National Water Act (Act No. 36 of 2008) ("NWA"), process. I&APs were given an opportunity to do so by telephone, fax and/or email.

All the issues that were raised by I&APs during the consultation process were captured in a Comment and Response Report. Refer to *Annexure 2* for further details on the Public Participation Process.

REGULATION 50 (g)

14. The appropriate mitigatory measures for each significant impact of the proposed mining operation.

Impacts on Water Resources:

Groundwater contamination of seepage from stockpiles and other construction and operational related contaminants and contamination of surface water resources. As well as dewatering of the aquifer.

Mitigation

- It is essential to monitor surrounding boreholes to build a reliable database. The groundwater monitoring system must adhere to the criteria as specified within the Geohydrological Report;
- It is important to monitor static groundwater levels on a quarterly basis in all boreholes within a zone of 2 km surrounding the mine to ensure that any deviation of the groundwater flow from the idealized predictions is detected in time and can be reacted upon appropriately. Preferred flow structures (dykes, sills, faults etc.) have not been included in the model due to the unknown hydraulic characteristics, and these structures could alter the actual effects considerably; and
- The affected users of groundwater in the area should be compensated. This may be done through the installation of additional boreholes for water supply purposes, or an alternative water supply.
- Water availability and quantity needs to be monitored regularly to ensure that basic needs and human health are not compromised;
- When chemicals e.g. paint, fuels and oils are handled during construction and maintenance, impermeable material (drip tray) must be placed underneath to prevent spilling on the ground;
- It must be ensured that a credible company removes used oil after vehicle servicing;
- A sufficient supply of absorbent fibre should be kept at the site to contain accidental spills;
- Used absorbent fibre must be land-farmed, using approved methodologies;
- Domestic waste water, especially sewage, must either be treated at site according to accepted principles, or removed by credible contractors;
- Solid waste must similarly either be stored at site on an approved waste dump, or removed by credible contractors;

- To assess the impacts of the stockpile area on the groundwater regime a groundwater analysis need to be undertaken;
- Groundwater monitoring must be conducted according to the specifications in the Geohydrological Report:
    - Although no or little groundwater contamination is expected during the mining phases due to the cone of depression, it is nevertheless recommended that groundwater quality be monitored on a quarterly basis. This is essential to provide a necessary database for future disputes.
    - Water samples must be taken from all the monitoring boreholes by using approved sampling techniques and adhering to recognised sampling procedures. Samples should be analysed for both organic as well as inorganic pollutants, as mining activity often lead to hydrocarbon spills in the form of diesel and oil. At least the following water quality parameters should be analysed for:
        1. Major ions (Ca, K, Mg, Na, SO4, NO3, Cl, F)
        2. pH
        3. Electrical conductivity (EC),
        4. Total Petroleum Hydrocarbons (TPH)
        5. Total Alkalinity
    - These results should be recorded on a data sheet. It is proposed that the data should be entered into an appropriate computer database and reported to the Department of Water Affairs;
- Management of the stockpile in accordance with Section 73 of the MPRDA Regulations (No. R527, 2004).
- Vehicles are to be maintained in good working order so as to reduce the probability of leakage of fuels and lubricants;
- A walled concrete platform, dedicated store with adequate flooring or berm area should be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas;
- Storage of potentially hazardous materials should be above any 100-year flood line, or as agreed with the Environmental Control Officer. These materials include fuel, oil, cement, bitumen etc.;
- Surface water draining off contaminated areas containing oil and fuel would need to be channelled towards a sump which will separate these chemicals and oils;
- All materials prone to spillage are to be stored in appropriate structures with impermeable flooring;
- Chemical toilets are to be provided and maintained for construction crews. Maintenance must include their removal without sewage spillage;
- Under no circumstances may ablutions occur outside of the provided facilities;
- No uncontrolled discharges from the construction crew camps to any surface water resources shall be permitted. Any discharge points need to be approved by the relevant authority;
- In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately;
- Store all litter carefully so it cannot be washed or blown into any of the water courses within the study area;

- Provide bins for staff at appropriate locations, particularly where food is consumed; the construction site should be cleaned daily and litter removed;
- Conduct ongoing staff awareness programs so as to reinforce the need to avoid littering; and
- Care should be taken to contain contaminated water and prevent it from seepage to the aquifer. Therefore it is especially important that, product stockpiles, tailings dams and dirty water dams should be properly lined.
- These include the containment and treatment of pollution sources with measures such as treatment of contaminated water, monitoring of borehole yields in the expected cone of depression to assess the impact of dewatering and correctly manage the process;
- Store overburden and spoil stockpiles out of the immediate watershed riparian zones of watercourses;
- Runoff water from the waste dumps, stockpiles and contaminated stormwater should be channelled into pollution control dams to avoid effects on the aquatic ecosystem;

- Prevent contaminated water entering the environment; - both groundwater and surface water, should be adequately contained or treated before being allowed to enter into aquatic ecosystems in a controlled manner; and
- Prevent mixing of clean and dirty water by constructing suitable stormwater management infrastructure.

Impact on Change in Surface Cover

Mitigation:

- The absolute minimum amount of vegetation and topsoil should be removed from the project area. Ensure that all existing natural vegetation is retained wherever possible and incorporated into the site design, especially on the periphery of the project area;
- Ensure that conveyor belts are designed to follow the natural contours of the land to avoid extensive cut or fill areas;
- Rehabilitate exposed construction areas with grasses and/or groundcover vegetation as soon as is practical to do so;
- Dust suppression measures should be in place at all times during the construction and operational phases;
- Harsh, steep slopes where possible will be avoided, as these could impose an additional impact on the landscape by contrasting with existing topographic forms;
- Only the footprint of the proposed stockpiles, buildings and other infrastructure should be exposed. In all other areas, the natural vegetation should be retained;
- Where possible and in line with the closure objectives an ecological approach to rehabilitation, as opposed to a horticultural approach to landscaping, will be adopted. For example, communities of indigenous plants enhance biodiversity and blend well with existing vegetation. This ecological approach to landscaping costs significantly less to maintain than conventional landscaping methods and is more sustainable.

- Structures that are required to be built from steel or concrete can be painted in battleship grey to blend in with the surrounding environment. To reduce the amount of glare, external surfaces of buildings and other structures should be articulated or textured to increase the interplay of light and shade;
- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the run of mine tip and crusher;
- Avoid high mast security lighting along the periphery of the site and use only lights that are activated by movement upon illegal entry to the site; and
- Lighting on the portal will be localised to those areas where workers are operating at the time.

Impacts Relating to Disturbance of sensitive Flora

Mitigation:

- The *Acacia erioloba*, *Acacia heamoxtylon* and *Boscia albitrunca* trees occurring on the study area are endangered species. These trees are considered important and nationally protected under the National Forestry Act, 1998 (Act No. 30 of 1998). A tree removal license should be applied for at the department of Agriculture, Forestry and Fisheries, for the protected species should the proposed project be authorised;
- Where possible these trees should be replanted adjacent to the proposed activity site on the same property if possible; and
- Should relocation of trees not be possible these trees should be replaced by trees of the same species or other indigenous and endemic trees.

Veld Fires:

Mitigation:

- During the construction phase construction workers may not make any fires for cooking or to keep warm during the winter months;
- Construction workers should provide for pre-prepared food to bring with to the site;
- Construction workers must wear appropriate clothing for weather conditions;
- A veld fire warning system should be implemented; and
- A veld fire contingency plan or response plan to veld fires should they occur should form part of health and safety measures.

Impact on Heritage Features

Mitigation:

Remaining Extent of the Farm Mamatwan:

- The homestead on the Remaining Extent is older than 60 years, and is subsequently protected under the National Heritage and Resources Act, 1999 (Act No. 25 of 1999). The specialists recommend that this structure should be retained.

- The specialists recommend that a conservation buffer of 20 m be placed around the graveyard in close proximity to the homestead, as all graves are protected under the Human Tissue Act, 1983 (AAct No. 65 of 1983) and Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925), while graves older than 60 years are protected under the National Heritage and Resources Act, 1999 (Act No 25 of 1999).
- Due to the presence of LSA artefacts in a 200 m radius of the dry riverbed on the western section of the Remaining Extent, the specialists recommend that no development take place within the buffered area. Should the need for development within this buffer arise, it is recommended that a Phase 2 Archaeological Impact Assessment be conducted prior to any construction or development activities.

Portions 3, 8 and the demarcated section of Portion 19 of the farm Mamatwan 331:

- Due to no visible remains pertaining to heritage resources development may continue on these Portions; and
- Should culturally significant material or skeletal remains be exposed during development and construction phases, all activities must be suspended pending further investigation by a qualified archaeologist (Refer to the National Heritage and Resources Act, 25 of 1999 section 36 (6)).

Socio-Economic Impact

Impact on Employment

The impact on employment is positive. The proposed Mamatwan Manganese Mine will create numerous job opportunities for local residents during the construction, operational and decommissioning and rehabilitation phases. However it could also have a negative impact on employment in the area, should local residents not be employed.

Land Acquisition

Due to the nature of the project, landowner negotiations are underway with landowners whose surface rights will be impacted on.

Mitigation:

- Mitigation measures will include a detailed lease agreement that sets out compensation and other land use arrangements.

Reduction in Air Quality:

Mitigation:

- These include dust suppression measures along roads, enclosure of crushing operations, ambient PM_{10} monitoring, and the implementation of a dust fallout monitoring network. Monitoring will need to take into

account residents remaining on land portions directly affected by air quality impacts, and assess the situation on a regular basis to determine the significance of impacts and potential addition mitigation requirements.

- All topsoil stockpiles and cleared areas should be re-vegetated, covered or kept moist to prevent dust generation;
- Dust suppression through the use of water bowsers should be implemented on all exposed areas including roads, parking zones and lay down areas. Water spraying on high use roads should be prioritised. If chemicals are used to assist dust suppression they must be environmentally benign;
- Construction activities should be conducted using methods that minimize dust generation; and
- All onsite traffic can be restricted to specific designated roads. Off-road travel can only be authorized on a case-by-case basis (e.g. access to a remote monitoring well, etc.). Traffic speed can also be restricted to an appropriate level on all designated roads.

Noise

Mitigation:

- Vibration and noise resulting from blasting will be minimised by appropriate blast design and reducing blasting to what is absolutely necessary;
- Local residents will be notified of any potentially noisy field survey works or other works during the planning and design phase and these activities will be undertaken at reasonable times of the day. Where possible these works will be limited to daylight hours excluding Sundays. Additional Noise mitigation measures to be considered during the construction phase are as follows:
- Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas close to the development sites;
- All construction vehicles and equipment are to be kept in good repair;
- Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20dBA;
- Construction activities, and particularly the noisy ones, are to be confined to reasonable hours during the day and early evening if possible;
- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact;
- Machines in intermittent use should be shut down in the intervening periods between work, or throttled down to a minimum.
- In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993); and
- Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA should wear hearing protection equipment.

Further mitigation measures entail including the design of all major infrastructures to incorporate acoustic design aspects that use latest technology incorporating maximum noise mitigation measures for components of the mine infrastructure, the use of stockpiles as interim or long-term noise attenuation barriers, regular maintenance of all equipment and noisy activities restricted to day time.

Mamatwan Manganese Mine will develop a grievance register will ensure that the residents' complaints are addressed timeously, reducing the significance of the potential noise impacts. This grievance register will also address potential concerns over ongoing impacts to air quality and water.

It is further recommended that monitoring be undertaken at remaining sensitive receptors to determine the impact of noise during operations and potential addition mitigation requirements.

- Ecological impacts Such as: Habitat loss and degradation, Habitat fragmentation; Spillage of harmful or toxic substances; exotic and / or declared invader species

Mitigation

- Where possible, all proposed infrastructure and mining activities should be restricted to areas already transformed, degraded or developed;

- Vegetation clearing in natural areas should be kept to a minimum and restricted to the proposed development footprint only. Areas designated for vegetation clearing should be identified and visibly marked off;

- Where possible, construction activities should not take place in wetland environments, and if unavoidable, only minimal disturbance should be permitted;

- The management of Red Data and protected species of flora and fauna should be prioritised during the vegetation clearing phase – refer to recommendations regarding the management of species of conservation importance;

- It is recommended that an environmental control officer (ECO) be appointed during construction to oversee the vegetation clearing process and as well as all other construction activities and their environmental consequences; and

- Removed topsoil should be stockpiled and used to rehabilitate disturbed areas. Ideally, topsoil stockpiles should not exceed 2 metres in height.

- In order to prevent the obstruction of surface and subterranean water flow in wetland and aquatic environments, linear infrastructure should be raised above ground level and the footprint area required for foundation infrastructure should be kept to an absolute minimum; and

- To prevent the obstruction of fauna dispersal and movement patterns, culverts should be installed at regular intervals along conveyor routes, fences and access roads to allow easy access across the barrier.

- A rehabilitation plan, including active re-vegetation of disturbed areas with indigenous species, should be developed and implemented in areas where mining activities have ceased.

- In accordance with SANS 310 of 2007, all harmful or toxic substances kept on-site should be stored in bunded areas with the capacity to contain 110% of the largest predictable spillage, and in the correct manner as stipulated by the relevant Material Safety Data Sheets (MSDS);

- Harmful or toxic solids and gases will be stored in appropriately secure facilities in the manner stipulated by their MSDS; and

- An emergency spillage containment plan should be developed and implemented to address the spillage of harmful and toxic substances.

- Minimising unnecessary ground clearing, which will create areas for colonisation by exotic and / or declared invader species;

- An exotic species control programme, including monitoring, must be developed and implemented to reduce the encroachment of exotic invasive species; and

It is recommended that the environmental control officer (ECO) be responsible for monitoring the nature and extent of on-site exotic, invasive plants. Exotic fauna species can be controlled by, Implementing control programmes for exotic species; and reducing breeding and foraging areas for exotic species (rubbish dumps etc.).

It is recommended that an environmental control officer (ECO) be appointed during construction to monitor for the presence of Red Data and protected flora and fauna, and to supervise rescue and relocation operations.

A list of all possible red data species in the area will be compiled and the ECO and the supervisory mining personnel will familiarise themselves with the list and identification of species. One method to achieve this is to compile a field guide with a description and pictures for identification.

14.1. Adequacy of predictive methods utilised

The environment that is likely to be affected by the proposed project was assessed and the EIA (this report) has covered all prevailing conditions of the environmental aspects identified, including cumulative impacts. It is believed that the environment is well understood. Hence, no significant knowledge gaps exist in terms of the current state of the environment, EIA (this report) and the EMP.

Due to the nature of the existing environment, the local conditions of the area, and professional expertise, it is believed that the predictive measures are suitable and contain no limitations.

14.2 Adequacy of underlying assumptions

The underlying assumptions are all deemed adequate.

14.3. Uncertainties in the information provided.

There are no uncertainties in the information provided.

REGULATION 50 (h)

15. Arrangements for monitoring and management of environmental impacts.

15.1. List of identified impacts which will require monitoring programmes.

All the areas identified as having an impact will be monitored on a monthly basis. The findings from these monitoring sessions will be included into a bi-annual performance assessment. Performance and compliance levels will be measured against the acceptable limits as specific by law and or applicable SANAS standards.

DUST AND AIR QUALITY MONITORING:

Passive sampling (Gravimetric Dust Bucket)

This method entails a dust stand and bucket at a minimum of eight locations on the peripheral area of the operation, these are selected by using the main compass point directions.

Three (3) cycles of Dust fall out samples per quarter is taken (thus monthly), analysis includes gravimetric (mg. m^3 / day) and one metals scan per quarter.

Gravimetric analysis of dust fall out is done according to SANS 1929 methodology at an independent registered laboratory.

Active sampling (High volume dust sampler EVM 07 Quest)

- Active sampling includes 8 suites of samples on the 8 sampling sites (main compass point directions).
- A suite includes SO_2, NO_2, HF, HCl, VOC, CO_2 en PM_{10} and PM 2.5.
- Analysis is done on site by the EVM 7 Environmental Monitor device.
- Standards applied
- Analysis of all samples (active and passive) are done bunder the SANS 1929: 2004 methodology at a registered independent laboratory.

SURFACE WATER MONITORING

- Sampling methodology applies predetermined points within the landscape with probability of influence by operational water flow and discard is sampled on a monthly basis.
- Analysis includes Chemical, Biological and Metal tests.
- DWEA guidelines, general standards and SANS 241:2006

GROUNDWATER MONITORING

- Sampling methodology includes the testing of predetermined boreholes affected or used by operations are sampled on a quarterly basis or on a frequency requested by the owner or in compliance with the Environmental Management Plan of the organisation.
- All ground water tests according to SANS 241: 2006 methodologies at an independent and registered laboratory.

15.2. Functional requirements for the said monitoring programmes

The purpose of the monitoring programmes is to review the mine's impact on various aspects of the environment and to report on changes needed to the management programme as proposed in this report.

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

- a formal procedure;
- appropriately calibrated equipment;
- where samples require analysis they will be preserved according to laboratory specifications;
- an accredited, independent, commercial laboratory will undertake sample analyses;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;

- if necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority;
- monitoring data will be stored in a structured database;
- data will be interpreted and reports on trends in the data will be compiled by an appropriately qualified person on a monthly basis; and both the data and the reports will be kept on record for the life of mine.

15.3. Roles and responsibilities for the execution of the monitoring programmes.

The roles and responsibilities for the execution of the monitoring programmes are defined below.

Programme Manager who will:

- Ensure that the monitoring programmes are scoped and included in the annual mine budget;
- Identify and appoint appropriately qualified environmental specialists to undertake the programmes; and
- Appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards;
- Establish and maintain good working relations with surrounding communities and landowners; and
- Facilitate stakeholder communication, information sharing and grievance mechanism.

15.4. Time frames for monitoring and reporting.

Monthly monitoring and reporting will take place.

Programme	**Timeframe and frequency**	**Reporting***
Waste dumps and water dams	All project phases Daily and monthly by dam operators and quarterly by professional engineer	Monthly internally and quarterly by professional engineer
Biodiversity	All project phases Annually	Annually by independent practitioner
Groundwater and surface water	All project phases Monthly (water levels), quarterly (water qualities), annually (update groundwater model and climatic water balance)	Quarterly and annually by independent practitioner Annually to DWA
Air	All project phases Monthly (dust)	Monthly as well as Quarterly reports to be compiled by independent practitioner and annually by specialist
Noise	From the start of construction to the end of decommissioning Annually	Annually by independent practitioner
Blasting	During operation of the mine Every blast	Monthly by specialist

** The requirements of any water license and any other authorisation take precedence over these timeframes.*

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)

Annexure 1: Authority Correspondence

Annexure 2: Public Participation

Annexure 3: Specialist Reports

Annexure 4: Technical Information

Annexure 5: Impact Assessment and Mitigation Measures Report

Annexure 6: Environmental Management Programme

Annexure 7: Maps and GIS

Annexure 8: Financial Provision and Quantum Calculations

Annexure 9: Environmental Awareness Plan

SECTION 2 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.

The following aspects describe the pre-mining environment, this list serves to guide the setting of environmental objectives for mine closure:

- Topographical features;
- Soils that support agricultural potential and hydromorphic soils;
- Biodiversity that ranges in sensitivity from very low to medium high based on vegetation communities, vertebrate and invertebrate groups identified on site;
- Heritage features;
- Perennial and non-perennial patterns;
- Moderate to good groundwater quality; and
- Stable water table providing groundwater as a water supply source and feeding streams in the upper reaches.

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.

The following measures are required to contain and or remedy pollution:

- Implement a waste management procedure for general and hazardous waste on site;
- Ensure immediate clean-up of any spills as per the emergency response procedures;
- Establish and maintain dirty stormwater control measures in line with regulatory requirements, until such time as potentially polluting area are rehabilitated;
- Contain pollutants at source by storing and handling potentially polluting substances on impermeable substrates, within bunded areas and with the capacity to contain spills;
- Design, construct and operation of proposed tailings dam with decant and drainage systems and runoff control measures;
- Design, construct and operate future waste dumps with runoff control measures; and
- Rehabilitate the site in line with a detailed closure plan.

For further detailed mitigation measures, refer to *Annexure 5*: Impact Assessment and Mitigation Measures Report.

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.

Air quality monitoring;

Surface water monitoring; and

Groundwater monitoring.

2.2 List of the source activities that are the cause of the impacts which require to be managed.

All mining related activities inclusive of construction of mine infrastructure, the operational phase, closure and post closure phase are considered to constitute source activities that cause impacts. A summary list of such activities is provided below:

- Site preparation;
- Power supply infrastructure;
- Loading and unloading of material;
- Road use and maintenance;
- Contractors operational areas;
- Underground activities;
- Hydrocarbon and other hazardous chemical substance offloading, storage, handling and disposal;
- Product stockpile areas; and
- Support facilities.

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.

Monthly monitoring of:

Water quality; and

Dust monitoring.

This will be undertaken as a requirement of the mine monitoring programme.

2.4 The roles and responsibilities for the execution of the monitoring and management programmes.

A site manager will be appointed by Mamatwan Manganese (Pty) Ltd to assume the responsibility for implementing the management guidelines contained in this document.

It is also recommended that a suitably qualified person be appointed by the proponent to undertake site evaluation, monitoring and implementation of the EMPr. The environmental control officer (ECO) should conduct regular site visits (at least once in two week) during the construction phase and every three months for the first year of operation to audit the project and to ensure the success of the EMPr. The ECO should have the authority to stop any activity deemed to be in contravention of this EMPr.

The ECO will:

- Know the background of the project and monitor the implementation of EMPr;
- Act as a guide and advisor to the mining team on environmental issues during preparation and operation.
- Conduct periodic auditing of the project for adherence to the EMPr, identification of problem areas and provision of action plans to avoid costly stoppages and/or further environmental damage;
- Ensure that open communication lines exists to Northern Cape DENC and the Department of Water Affairs (DWA) or other identified authorities for reporting of any significant environmental incidents and rapidly resolving any problems or complaints from the public;
- Ensure that any proposed changes are communicated in writing to the authorities for approval; and
- Ensure the protection and rehabilitation of the surrounding environment during the operational phase as prescribed in this EMPr.

The role and responsibility of the ECO will be fulfilled by the Mine's Environmental Section with very limited capacity. Where insufficient capacity resources are available and external ECO will be appointed as part of the mining phase of the project.

Overall responsibility for the implementation of the EMPr lies with Mamatwan Manganese (Pty) Ltd, through their appointed site manager who will:

- Notify DMR and Northern Cape DENC of changes in the projects resulting in significant environmental impacts.
- Maintain a register of complaints and queries by members of the public.
- Offer assistance with the implementation of the EMPr and the resolution of any problem areas will be the responsibility of the ECO, as will the design and review of the monitoring program.

DMR, Northern Cape will be responsible for approving the EMPr for this project. DENC will issue the environmental authorisation (EA) for the listed activities undertaken and the DMR will approve the EMPr addenda.

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)

The objectives and goals for the socio-economic conditions will entail abiding by all prescriptions of the laws pertaining to socio-economic matters, furthermore the objectives will entail monitoring and enhancement of the following impacts:

1. Economic impact of the Project on local areas in respect of:
    - Number of jobs directly created;
    - Number of jobs indirectly created;
    - If possible the multiplier effect on downstream economic activity and jobs;
    - Projected number of households/household members benefiting both directly and indirectly from the mine's operation;
    - Housing and living conditions; and
    - Other socio-economic benefits.
2. Employee and contractor profiles;
3. Training strategy and plan in respect of:
    - Estimated costs;
    - Time frame;
    - Redeployment opportunities;
    - Alignment with Mining Qualifications Authority and other relevant Departments;
    - Employment equity issues; and
    - Skills gaps in relation to existing and potential economic opportunities.

4. Socio-economic background and key economic activities of the local municipality in which the mine operates. This includes local municipalities (LM), district municipalities (DM) and the Province from which the mine draws its labour and from which it sources supplies or services.

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.

- The protection of all identified protected heritage features on the property where the mine is proposed, including the homestead older than 60 years; the graveyard with 5 graves and the stone tools dating from the LSA within 200m of the watercourse;
- Should any artefacts or remains be unearthed by mining or related activities, operations should cease immediately; the area fenced off and SAHRA notified promptly; and
- Should it be discovered that the artefact or remains are of cultural significance the area must be excluded from the proposed development in order to preserve the sites. The ideal situation would be to 'utilise' the heritage as part of the identity/image of the development.

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 follows;

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)

Refer to Annexure 5: Impact Assessment and Mitigation Measures Report

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)

- Removal of vegetation:

Only natural vegetation directly in the way of the mining area should be removed. Every effort should be made to preserve large indigenous trees on the sites by marking of these trees. Trees should be included in landscaping as far as possible. Mark indigenous and protected species and place the infrastructure in such a way to minimize the loss of these trees. Prevent vehicular and personnel access into undisturbed areas. Due to the compacting of the soil by vehicles or other means it will be necessary to scarify (rip) such affected areas, including haul and access roads, which will no longer be used as such. This is to allow for the penetration of roots and the re-growth of the natural vegetation. No seeding or re-vegetation is required. The natural vegetation will re-establish from the existing seedbed in the topsoil. Prevent uncontrolled burning, the burning of trash and dead plant materials. The burning of waste shall not be permitted on site. The making of open fires shall be restricted to demarcated areas on site. No vegetative matter shall be removed by contractors for firewood. Employees must be provided with designated areas for open fire cooking and shall be prevented from creating fires randomly outside these areas.

- Fauna and Flora habitat loss:

Only natural vegetation directly in the way of the construction area should be removed. Every effort should be made to preserve large indigenous trees on the sites by marking of these trees. Trees should be included in landscaping as far as possible. Prevent vehicular and personnel access into undisturbed areas. Due to the compacting of the soil by vehicles or other means it will be necessary to scarify (rip) such affected areas, including haul and access roads, which will no longer be used as such. This is to allow for the penetration of roots and the re-growth of the natural vegetation. No seeding or re-vegetation is required. The natural vegetation will re-establish from the existing seedbed in the topsoil. Prevent uncontrolled burning, the burning of trash and dead plant materials. The burning of waste shall not be permitted on site. The making of open fires shall be restricted to demarcated areas on site. No vegetative matter shall be removed by contractors for firewood. Employees must be provided with designated areas for open fire cooking and shall be prevented from creating fires randomly outside these areas.

- Reduction in biodiversity on site and in the region:

Only natural vegetation directly in the way of the mining area should be removed. Every effort should be made to preserve large indigenous trees on the sites by marking of these trees. Trees should be included in landscaping as far as possible. Prevent vehicular and personnel access into undisturbed areas. Due to the compacting of the soil by vehicles or other means it will be necessary to scarify (rip) such affected areas, including haul and access roads, which will no longer be used as such. This is to allow for the penetration of roots and the re-growth of the natural vegetation. No seeding or re-vegetation is required. The natural vegetation will re-establish from the existing seedbed in the topsoil. Prevent uncontrolled burning, the burning of trash and dead plant materials. The burning of waste shall not be permitted on site. The making of open fires shall be restricted to demarcated areas on site. No vegetative matter shall be removed by contractors for firewood. Employees must be provided with designated areas for open fire cooking and shall be prevented from creating fires randomly outside these areas.

- Safety and injury or loss to workers or other individuals on site:

Excavations will only remain open for a minimum period of time and during this time they must be clearly demarcated so as to prevent accidental ingress of people, animals or vehicles. Check excavations daily to ensure animals are not trap in them. Occupational health remains an area of importance and focus, during all activities. Ensure that a medical kit is available on site at all times and that emergency contact numbers are available to staff. Ensure that all operations take place under proper supervision. Ensure that the emergency spillage procedures are kept on site. Ensure that all staff is properly trained with regard to chemical handling.

Job creation - Positive:

The criteria for and selection of contractors and their labours for the project should demonstrate preference for the local community.

6. Action plans to achieve the objectives and specific goals contemplated in Regulation 50 (a).

6.1. 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)

Phases and Activities, Actions and Processes:	**Time frame:**
Pre-construction Phase:	
Permitting applications and granting of; • Mining Right, • Environmental Authorisation ;and • Water Use license	**2 years**
Construction Phase:	
• Appointment of mining contractor; • Construction of Processing Plant	**Month 1-12** (The construction phase will commence upon granting of authorisation) (The construction of the processing plant will take place in parallel with the build-up of ore production. The processing plant will be completed prior to the mining operation achieving its full production rate).
Construction of Shaft.	**Month 1 – 3**
Operational Phase:	
(The operational phase will commence after completion of the boxcut, the life of mine is estimated to be 9 years)	**Month 4 to Year 9**
Primary Access: Two declines (6 m x 6m in section) will be developed through the over burden. (Average advance rate of 40 m per month)	**17 Months**

Secondary Access: On-reef development access concurrently with the development of two ore declines and two ledging drives, one on either side of the ore declines. All development ends will be 5 m in width and 5.3 m in height. It is assumed that these ends will advance together at 40 m per month. At the 40 m per month development rate, the reef access declines and ledging development will open up the first production section in approximately 4 months.	**Month 21 to 24**
Full production: The mine will attain its full production capacity during this phase. The subsequent two ore production sections will be available to produce by production month ten.	**Month 25 – Year 9**
Decommissioning Phase:	
Ramp down and closure	**From year 9** (Rehabilitation will run concurrently with the mining programme, however filling of the final void, reinstatement of dams and roads will commence towards the end of the life of mine).
Rehabilitation Phase:	**From year 9**

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)

Of all the potential area of emergency, the following were identified as the possible areas of focus (there are a number of other emergency situation where this procedure applies):

- Uncontrolled fire/explosion
- Oil spills
- Burst pipelines
- Flooding
- Chemical spills

7.1 Procedures for the remediation of the environment related emergencies

Mamatwan Manganese (Pty) Ltd is committed to establishing and maintaining procedures to identify potential emergency situations, to respond to emergencies and to mitigate any resulting safety, health and environmental impacts. In addition, the organisation will review its emergency procedures (particularly after emergency situations) and periodically test such procedures where practicable. This Environmental Emergency Plan (EEP) describes the procedures Mamatwan Manganese (Pty) Ltd has in place with regards to the preparedness and response to environmental emergencies. The Environmental policy aims at prevention of emergencies and therefore all possible measures are taken to eliminate or reduce the potential causes of emergencies.

An Emergency is defined in this plan as an unplanned situation or event resulting in involvement of the emergency services, police, fire, paramedic or the regulatory authorities. Emergencies include accidents and emergency incidents.

Mamatwan Manganese (Pty) Ltd aims to avoid environmental accidents by carrying out systematic risk assessments and implementing appropriate control measures. Nevertheless, there may be situations where employees, contractors or visitors may be involved in an incident. All work related environmental accidents, dangerous occurrences, spillages and incidents which have resulted in major environmental emergencies or damage to property should be properly investigated and reported on Mamatwan Mining Emergency situations Investigation Report Form.

To accomplish this purpose, a Quick Reaction Team has been developed to respond to emergencies.

To establish a procedure to guide actions required to respond to an emergency event and to provide meaningful, planned, co-ordinated, organised and disciplined joint action during an environmental emergency.

To prevent and/or minimise environmental spillages, emergencies, damage and disruption at the mining office and mining sites as far as possible.

It will be applicable at the Mamatwan mining office, where the periodic testing of the emergency procedures as well as the periodic review of the procedures, particularly after an accident or emergency situation is required.

The procedure applies to all employees, contractors and suppliers within every work area of the mine.

7.2 Scope and Application

7.3 Objectives of Emergency and Remediation Procedure

This environmental emergency section of the EMP describes the planned response to emergency situations. It addresses the following concerns:

1. Identification of potential accident and emergency situations and events;
2. Roles and Responsibility;
3. Planned response;
4. Provision of equipment and facilities;
5. Reporting of emergencies; and
6. Review of procedures.

7.4 Identification of potential environmental emergencies

Significant environmental aspects and their associated environmental impacts were identified for all Mamatwan Manganese Mine operational areas. In the process of identifying the environmental aspects and associated impacts and in formulating the EEP the following factors were taken into consideration: -

1. All significant environmental aspects identified under emergency conditions;
2. Historic emergency events of activities, products and services on/ off the site;
3. Chemicals, oils and other materials used on site;
4. Activities of contractors;
5. Concerns of communities and authorities were submitted;
6. Proximity to sensitive areas such as residential areas, schools, wetlands, rivers etc;
7. Availability of local emergency services; and
8. Availability of trained, on-site personnel for emergency situations.

Potential emergency situations identified on Mamatwan Manganese Mine includes, but not limited to:

1. Petrochemical/chemical spillages,
2. Hazardous material spillages,
3. Fire – any situation which could be contained,
4. Untreated effluent spillages,
5. Spills of material,
6. Pipe rupture / burst,
7. Rupture of tanks or holding containers,
8. Explosion – involving flammable substances or electrical apparatus,
9. Social unrest,
10. Floods,
11. Any other threats which may result in an emergency, and
12. Explosions and natural disasters.

Emergency plans have been documented for each of these stipulated emergencies, which include responsibilities in emergency situations, corrective and preventative actions and the reporting of such emergencies.

Where practicable, management measures were introduced to reduce the risk of such environmental emergencies occurring.

A site map indicating various aspects related to the potential SHE emergencies on site.

The site map includes the following information: -

- Identification of evacuation routes;
- Identification of safety showers and eye-wash stations;
- Identification of fire extinguishers;
- Identification of spill containment equipment;
- Effluent drains, stormwater channels, sewage treatment and other water systems;
- Site infra-structure such as bulk storage facilities and Major Hazard Installations;
- Prevailing wind directions and neighbouring communities and facilities; and
- Emergency Generators.

7.5 Roles and Responsibility

All Mamatwan Manganese (Pty) Ltd employees and contractors working Mamatwan Manganese (Pty) Ltd are responsible for reporting any accident / emergency to their supervisor immediately, and if required to notify the emergency response teams according to the Mamatwan Manganese (Pty) Ltd emergency call out procedure.

The Mamatwan Manganese Mine is responsible for the annual testing and review of the applicable emergency response procedures. The periodic testing of response unit telephone numbers as well as testing of employee response must be carried out. All records of testing must be kept and maintained according to the EMS Records Procedure.

Personnel nominated as response team members will receive appropriate training to manage emergencies. All other personnel will be made aware of potential emergencies and trained in evacuation and call out procedures. Where practicable, personnel will participate in regular practice drills to test the effectiveness of the procedures and plans. Emergency plans are reviewed and tested by practice drill at least annually. The results of drills are reviewed and documented including any amendments to training, changes to procedures, plans or equipment.

- Emergency Controller

In the event of a serious environmental emergency where intervention is required by emergency response teams, the emergency controller assumes overall control to ensure actions are coordinated to reduce the effects of the emergency.

The Emergency controller is responsible to communicate with external and internal emergency teams ensuring that clear status reports are available on the situation;

a) Type of incident,
b) Location of incident,
c) Possible number of injuries and types
d) Evacuation status

After notification of a possible Emergency the Emergency controller will;

- Proceed to the assembly point of the area in question and based on information available assess the situation and direct all activities.
- Ensure that the receptionist has notified the required external emergency response teams.
- Communicate with Municipal Emergency Response team co-ordinator on status of emergency.
- Co-ordinate evacuation activities – collect the Assembly point attendance registers communicate with SHE manager on status of missing persons.
- Ensure that records of all casualties are available and passed on to the Human resources representative. Names of the casualties may not be released to any source until their next of kin have been notified.
- The emergency controller is not responsible for releasing any information to the public or media, the controller may merely confirm an incident has occurred and that a statement will be issued by an appointed representative.
- When an emergency has stabilised the emergency controller may on the advice of the Emergency response team commander declare the all clear.

- If employees are allowed back into the building the emergency controller will coordinate this with the evacuation marshals.
- Should the Emergency Response commander require a full evacuation that is away from the building then the Emergency controller will coordinate this with the evacuation marshals.
- Where the emergency results in permanent damage to the buildings the emergency controller will along with the Contingency plan manager notify employees of further action to be taken.
- The emergency controller is responsible to ensure the emergency plan is reviewed from time to time to ensure actions remain current.

- Mine Manager

The mine manager will be notified of an emergency in one of the following ways;

- Contacted directly by persons discovering incident
- Receptionist will notify via telephone system
- Emergency controller will contact the mine manager.

On notification of an emergency the following actions are required;

- The mine manager will assume overall control of the area allocated to them.
- An assessment of the situation will take place to determine action as appropriate, unless the emergency controller gives the direct instruction to immediate evacuation or partially evacuation of the area.
- If there are injured persons the first aid assistance will be required, the emergency controller will be notified and first aid assistance will be sent to the required location if this can be achieved safely.
- Arrangements will be made to guide the first aider or emergency repose team to the location of the injured persons.
- The emergency controller will be informed of the nature and extent of the emergency, which areas, if any, should be evacuated and safest escape routes to be taken.
- All personnel not required for essential duties are directed to the relevant emergency exits, fire exits and assembly points outside.
- A final sweep will be made of the operational area to ensure all persons have evacuated, this may only be completed if this action will not endanger the mine manager.
- The Roll Call Controller (supervisor) will call the names on the list to check that all workers are accounted for.
- The evacuation marshal shall assist in arranging to have casualties removed to hospital.
- Where possible the marshal will assist appointed persons establish the cause of the incident and record relevant facts.

- Duty Security Officer

NORMAL WORKING HOURS

On hearing the alarm or if the security officer is informed of an emergency event:

- The officer will activate the security panic button to inform the Security Controller.
- Contact the receptionist for instructions from the Emergency Controller.
- Access to the Parking area must be restricted to all vehicles except Emergency Response Vehicles.
- The security officers will standby outside the entrance of building or other mining area and await further instruction.
- The security officer will be required to arrange for the gate to the assembly area to be opened. Contact must be made with security personnel to ensure clear access is provided.

AFTER HOURS

- Depending on the type of emergency the officer will contact the Emergency Response Centre via telephone line.
- Exact information must be given on status of emergency.
- Restrict access to the parking area to all vehicles except Emergency Response Vehicles.
- The officer will direct the response team to the location of the emergency.
- The Security officer or the Security Controller may give no information out to the media, next of kin or any other person, other than through the appointed persons.

- Persons Discovering An Emergency

Should any person discover a situation which may develop into an emergency, the person is responsible to react in a calm and responsible manner. Actions taken must ensure the most efficient actions can be taken to reduce the effects of the potential emergency.

- The person must immediately notify the receptionist who will, base on the nature of the incident contact the relevant emergency response team and mine manager.
- If the person discovers a fire and has been trained to use a fire extinguisher they may attempt to extinguish the fire. This should not be attempted alone, notify a college who will then report to the receptionist.
- Where electrical equipment is involved, switch off power supply, if this can be done safely.
- If the injury is of a serious nature, the casualty must not be move except where there is a possibility of further injury and this should only be done by the first aider.

- Do not remove any objects involved in the incident.
- Take note of the time and circumstances of accident.
- After reporting the incident and if the situation requires then move out of the building to the assembly point.
    - All Personnel

On hearing the alarm all persons must remain calm and await instructions from the emergency controller unless the situation clearly requires immediate evacuation.

- All persons must terminate all telephone calls, this will free up the lines for emergency communication only.
- Unplug all electrical equipment if this can be done safely.
- Move to the assembly points without panic; follow instructions from emergency controller where they are present.
- Move directly to the assembly point and be sure you are marked present on the roll call register.
- No information may be given out to the press, next of kin or any other person, other than through the appointed persons.
- Persons allocated as assistants to disabled persons must ensure they assist them to the assembly points.
- At the assembly points, if you are aware of any persons who have left the building/area or who were not present then this must be reported to the supervisor.
- Wait at the assembly points for further instruction, if the all clear is given then move back to your work station.
- Report any out of the ordinary situations to the SHE/OHS Practitioner or Department head.
- Should a general evacuation be required from the assembly point then the Emergency response teams will guide all persons to a safe location.

IMPORTANT

- DO NOT congregate at the scene of the emergency unless directly involved in the emergency.
- No information may be given out to the press, next of kin or any other person, other than through the Mamatwan Manganese (Pty) Ltd appointed persons.

    - Quick Reaction Team

Their responsibilities include the following:

- arrange for evacuation of employees
- render first aid
- salvage and restore company operations

7.5 Response to Environmental Emergencies

The response plan for each of the identified potential emergency situations is reviewed to ensure that:

- Adequate plans, procedures and equipment are in place to respond to emergencies; and
- The environmental impacts associated with these emergencies are mitigated.

Follow these rules in an emergency:

- Stop work and leave the building or mining site IMMEDIATELY when the alarm sounds or when you are instructed to do so!
- Follow instructions, avoid panic, and cooperate with those responding to the emergency.
- Proceed to the designated or nearest exit.
- Turn off computers, equipment, vehicles or park at nearest safe zone.
- Do NOT delay your exit from the building/open cast area by looking for belongings or other people.
- When leaving the area, go to a clear area well away from the mining area.
- Do not obstruct fire hydrants or the responding fire/rescue workers and their equipment.
- Do not re-enter the building area until instructed to do so by your supervisor or fire/rescue worker.
- The above rules will be enforced. Periodic fire emergency drills may be conducted. Your life and the lives of others will depend on your cooperation.

General: Where an environmental emergency occurs, personnel at the scene shall render assistance to limit further damage. There must be minimum delay in calling emergency services. The first responder must judge how much information to obtain before emergency services are called and further provide information on an ongoing basis, as it becomes available.

Fire: In the case of fire, set off the alarm and notify emergency services immediately. Secure the scene and isolate the area allowing sufficient space for access by the emergency services and escape routes in the event of an escalation of the incident. Follow evacuation procedures.

Spill Incidents: Assess the risk by means of MSDS for the spilled substance before taking any action. Where necessary call the emergency services immediately. Secure the scene and isolate the area to ensure the safety of people and the environment. Efforts to protect the environment must be weighed against the possibility of becoming part of the problem. The first responder must remain in command of the scene of the incident until the arrival of emergency services at which time he passes on all relevant information to the person in command.

Compile a brief written report as soon as possible thereafter while the facts are still fresh.

Evacuation: An evacuation may be ordered when any hazard (e.g. fire, floods, hazardous substance spill, toxic fumes or bomb threat) exists which may endanger the building or operational areas. Evacuation must be done

according to a locally devised plan (site specific) which must take environmental hazards into account. Evacuation to be initiated by an alarm and done in accordance with Occupational Health and safety guidelines.

Hazard Communication: Employees have a 'right to know' and be informed regarding the chemical and other hazards that they and the environment are exposed to under normal conditions of use or in a foreseeable emergency. This document is applicable to all employees, including those working at remote facilities and operations, who engage in the use of hazardous chemicals. Information and inventories of hazardous chemicals, including MSDS's must be available at all times where they are used. Employees using these products shall be trained in the specific handling precautions of substances used for their work. Induction programs for new employees must include relevant information described here. Ensure through the use of appropriate and visible signs that employees not normally assigned to the work area are aware of the hazards to which these areas are subject. Report all working conditions, which may put the environment at risk.

Contractors: Ensure that contractors administer a hazard communications program where their activities warrant such. Provide them with a copy of the hazard communication program and ensure that they are provided with the MSDS's of the chemicals used or stored in the areas where they will perform their duties. Ensure that they are informed of the environmental policy and provisions and the precautionary measures relating to these on site. They must ensure proper labelling of containers that are use on site.

7.6 Reporting emergencies

Telephone hotlines are available 24 hours for the reporting and subsequent reaction to the emergency. Details are obtained from callers by the staff operating the hotline, in terms of basic information including type of emergency and appropriate details, time of call, location, caller identity etc. Call out procedural posters or notices are displayed across site. Hotline staff notifies response teams.

Response Team Telephone

The South African Police: 10111

Fire Department: (013) 243 2222 (013) 249 7222

Netcare: 082 911

7.7 Emergency plan

An Emergency Plan needs to be created for each potential emergency situation. Each plan will provide easy reference to relevant basic information for handling the situation. The Emergency Plan is not intended to be a comprehensive instruction for handling the emergency. This can only be achieved through training and regular practice drills.

Actual emergencies are reported and followed up by the SHE Management Procedure for Non-conformity, corrective action and preventive action procedure.

It is to be ensured that relevant government authorities are contacted by the SHE Departments in terms of the occurrence as per legislative requirements. Information relative to a particular emergency is documented in the respective emergency plan including:

e) Description of the emergency;
f) Reference to relevant material safety data sheets;
g) Responsibilities for management of emergencies;
h) Contact telephone numbers (on-site & off-site);
i) Equipment required (including locations); and
j) Site plan where applicable

7.8 Provision of Equipment and Facilities

Equipment associated with the identified emergencies is maintained as follows: -

Equipment	Responsibility
Fire extinguishers Fire hydrants Fire hose reels Emergency spill kits First aid boxes	Each working area is responsible for the maintenance of their fire equipment.
Front end loader Excavator	Individual sites maintain vehicles as required.
Emergency equipment	Emergency response team

7.9 Notifying the relevant government authorities

Emergencies must be reported within 24 hours by telephone or fax to the relevant government authorities.

Department	Telephone
Department of Mineral Resources	(053) 807 1700
Department of Water Affairs	(054) 338 5800
The South African Police	(053)-723 9106
Fire Department	(053) 739 2111
Department of Environment and Nature Conservation	(053) 807 7430

The information reported must include:

1. Contact Person and Contact Details;
2. Date and time of incident;
3. Reference to:
4. Sections 28 and 30 of the National Environmental Management Act (Act 107 of 1998);
5. Section 20 of the National Water Act (Act 36 of 1998);
6. The nature of the incident;
7. The substance involved and an estimation of the quantity released and the possible acute effect on persons and the environment and data needed to assess these effects;
8. Initial measures taken to minimise impacts;
9. Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure;
10. Measures taken and to be taken to avoid a recurrence of such incidents; and
11. A report, including the above-mentioned information, is to be submitted to the Director-General of Environmental Affairs within 14 days.

7.10 Preventative Measures

- Hazard Avoidance: Haul Roads, Aisles, passages and on site thoroughfares to be kept clear of obstructions. Permanent aisles and passageways should be appropriately marked. The area around exits shall be maintained so that they are unobstructed and accessible at all times
- Fire protection: Portable fire extinguishers suitable to each areas conditions and hazards shall be provided and in a ready to use condition. They should be conspicuously located and mounted so as to be readily accessible. Fire extinguisher training to be provided to designated fire marshals.
- Site inspection to include observation and reporting on site-specific aspects relating to this guideline.
- Appropriate evacuation procedures and a program of periodic drills shall be drawn up and maintained. The SHE Manager shall provide a suitable building and mining operational site evacuation procedure and take responsibility for the maintenance thereof.

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)

Regular monitoring of all the environmental management procedures and mitigation measures shall be carried out, to ensure that the provisions of this EMP are adhered to. Time frames and frequency of reporting are provided in the table below.

Programme	Timeframe and frequency	Reporting*
Waste dumps and water dams	All project phases Daily and monthly by dam operators and quarterly by professional engineer	Monthly internally and quarterly by professional engineer
Biodiversity	All project phases Annually	Annually by independent practitioner
Groundwater and surface water	All project phases Monthly (water levels), quarterly (water qualities), annually (update groundwater model and climatic water balance)	Quarterly and annually by independent practitioner Annually to DWA
Air	All project phases Monthly (dust)	Monthly as well as Quarterly reports to be compiled by independent practitioner and annually by specialist
Noise	From the start of construction to the end of decommissioning Annually	Annually by independent practitioner
Blasting	During operation of the mine Every blast	Monthly by specialist

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.

Mamatwan Manganese Mine will appoint an independent practitioner to conduct monitoring at the site on a continuous basis. The mine manager is required to ensure that any deficiencies are corrected immediately.
Annual performance assessments of the environmental management programme will also be conducted by an independent practitioner.

8.3 Frequency of proposed reporting for assessment purposes.

Programme	Timeframe and frequency	Reporting*
Waste dumps and water dams	All project phases Daily and monthly by dam operators and quarterly by professional engineer	Monthly internally and quarterly by professional engineer
Biodiversity	All project phases Annually	Annually by independent practitioner
Groundwater and surface water	All project phases Monthly (water levels), quarterly (water qualities), annually (update groundwater model and climatic water balance)	Quarterly and annually by independent practitioner Annually to DWA
Air	All project phases Monthly (dust)	Monthly as well as Quarterly reports to be compiled by independent practitioner and annually by specialist
Noise	From the start of construction to the end of decommissioning Annually	Annually by independent practitioner
Blasting	During operation of the mine Every blast	Monthly by specialist

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)

For a plan showing the mine layout, location and aerial extent refer to *Annexure 7*: Maps and GIS

9.2 Annual forecasted financial provision calculation (Refer to the concomitant section of the EIA and EMP guideline)

The financial provision for rehabilitation has been calculated according to the DMR quantum and provision for details in this regard refer to *Annexure 8*: Financial Provision and Quantum Calculations

9.3 Confirmation of the amount that will be provided should the right be granted.

Refer to *Annexure 8*: Financial Provision and Quantum Calculations

9.4 The method of providing financial provision contemplated in Regulation 53.

Determination of the financial provision (closure costing) has been undertaken aligned to the requirements of the DMR's financial provision guideline (2005), as well as to international good practice.

The approach or method followed with the determination of the closure costs is as follows:

- Gathering and collating the available information from the project knowledge base to devise the project closure context;
- Obtaining additional information, where required, on infrastructural layouts and mine planning;
- Compiling a bill of quantities (BoQ), or inventory, based on the available information at the time of this costing, on mine-related plant and infrastructure with measurements scaled from available drawings or as obtained from the mine planners;
- Determining applicable unit rates for the costing; an
- Compiling costing spread sheets, structured in terms of the following categories:
- Infrastructural areas;
- Mining areas;
- General surface rehabilitation;
- Water management;
- Post-closure aspects; and
- Additional allowances.

The financial provision will be provided by means of a bank guarantee.

For further detail refer to *Annexure 8* - Financial provision.

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)

An environmental awareness training manual has been developed for the mine. This is included as *Annexure 9*; Environmental Awareness Plan.

All employees must be provided with environmental awareness training to inform them of any environmental risks that may result from their work and of the manner in which the risks must be dealt with to avoid pollution or the degradation of the environment.

Employees should be provided with environmental awareness training before mining operations start. All new employees should be provided with environmental awareness training.

Environmental awareness and training is an important aspect of the implementation of the EMP. The onus is on the different parties involved in the various stages of the life cycle of the project to be environmentally conscious. Hence, it is suggested that all members of the project team are familiar with the findings of the site-specific EA report and the EMP. For instance, the contractor is responsible for the lack of environmental knowledge of his/her crew members. The contractor could forward internal environmental awareness and training procedures to the project manager and environmental officer for comment prior to the commencement of the project. Likewise, the above is applicable to the programming, design, operations and maintenance, and decommissioning teams. Environmental awareness ensures that environmental accidents are minimized and environmental compliance maximized.

All staff and contractors will be submitted to an annual training / awareness course as to inform the staff 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.

Section 39 (3) (c) requires that an applicant who prepares an EMProgramme or EMPlan must "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 the work and the manner in which the risks must be dealt with in order to avoid pollution and degradation of the environment". Environmental Awareness is required not only for management and employees (as described in Section 39(3)(c)) but also for visitors to the site. To this end, the following strategies and plans will be put into place for each of the parties.

Visitor Environmental Awareness:

Visitor/sub-contractor environmental awareness will be generated through the provision of a signboard describing very briefly the environmental considerations applicable to them. The signboard should contain the following information:

- Statement of the applicant's commitment to environmental principles.
- List of the "rules" to which the visitor must abide. This will include:
- No littering. Dispose of all waste in the bins provided.
- No fires
- Stay on demarcated roadways and paths only
- Kindly report any environmental infringements they may notice
- Check your vehicle/equipment for diesel/oil leaks

Staff of sub-contractors must also be given Environmental Induction Training as per *Annexure 9*: Environmental Awareness Plan.

Senior and Middle Management Environmental Awareness:

Achieving environmental awareness at upper levels of management is slightly different from the process at the operational level. There is often a fair level of the general value of environmental awareness but site-specific issues will most often need to be communicated. This will be achieved by:

- The management must make themselves fully au fait with the EMProgramme.
- Ensuring that there is a spare copy of the approved EMProgramme at his/her disposal. The management is encouraged to make notes in the document regarding the difficulty / ease of implementing the environmental management measures. These notes should be sent to the consultants to assist in future revisions of the EMProgramme
- The manager must ensure that the operators perform regular monitoring of their workstations / areas.

The management's execution of their activities/being at the site, the management must be constantly aware of and observant of especially the following:

- dust levels - movement outside of demarcated areas;
- litter management - general housekeeping;
- topsoil management - fuel/oil management/leaks/changes;
- success of operational re-vegetation; and
- alien vegetation.

Operator / Workforce Environmental Awareness:

Achieving environmental awareness amongst the operators and labour is probably the most important because they are usually present at the place where most environmental transgressions take place or in fact cause them. It is the aim of increased environmental awareness to reduce any such environmental transgressions.

Increasing environmental awareness at these levels can be achieved through the following strategies:

Induction environmental training: (As per the draft Environmental awareness Training document in *Annexure 9*: Environmental Awareness Plan) must take place prior to any contract period.

Training: Each and every employee (contractor or not) must go through an environmental training process where at least the following items area covered:

- The oil/fuel management policy must be explained to the employees. The reason for the policy must also be explained (i.e. to not impact on groundwater, surface water, soil quality etc.).
- The domestic and industrial waste management policy & method must also form part of the training;
- The topsoil handling method and the reasons for preserving topsoil (i.e. post mining re-vegetation, erosion prevention etc.);
- Alien vegetation management: How to recognize and remove such species;
- Protection of the natural veld by not driving/manoeuvring or walking through the demarcated protection areas. Reporting that demarcation posts/tape is broken or removed;
- Emergency management procedures such as dealing with oil spills or fires must also be drilled; and
- Such training will, in this case, be carried out by the site manager/resident engineer or the designated Environmental Control Officer (ECO)

11. Attachment of specialist reports, technical and supporting information. (Provide a List)

The specialists' studies describing the natural environment surrounding the proposed mine is attached in *Annexure 3:* Specialists' Reports.

The studies consist of the following:

- Geohydrological Assessment
- Surface Water Assessment
- Ecological Assessment
- Social and Labour Plan
- Heritage Impact Assessment

Technical and supporting information has been provided as *Annexure 4*: Technical Information.

- Concept Study

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)

Mamatwan Manganese (Pty) Ltd, has the technical and financial ability to manage and rehabilitate the environment. Details of their technical ability was included in the Mine Works Programme, whilst the financial ability has been proved in *Annexure 8*: Financial Provision and Quantum Calculations.

13. UNDERTAKING

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.

14. IDENTIFICATION OF THE REPORT

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises EIA and EMP compiled in accordance with the guideline on the Departments official website and the directive in terms of sections 29 and 39 (5) in that regard.	
Full Names and Surname	
Identity Number	
Signature	

14. LIST OF ANNEXURES

Annexure 1: Authority Correspondence

Annexure 2: Public Participation

Annexure 3: Specialist Reports

Annexure 4: Technical Information

Annexure 5: Impact Assessment and Mitigation Measures Report

Annexure 6: Environmental Management Programme

Annexure 7: Maps and GIS

Annexure 8: Financial Provision and Quantum Calculations

Annexure 9: Environmental Awareness Plan