DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED EMANG MMOGO OPENCAST MANGANESE MINE

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Prepared for:

Emang Mmogo PTY LTD

EMANG MMOGO MANGANESE MINE

Submitted to:

Department of Environment and Nature Conservation (DENC)

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EXECUTIVE SUMMARY

INTRODUCTION

Jomela Consultants(Pty) Ltd , as independent environmental assessment practitioners, has been appointed by Emang Mmogo(Pty) Ltd to facilitate the Environmental Impact Assessment (EIA) procedure for the proposed Emang Mmogo open cast mine in Northern Cape on the properties, Portion 4 (A portion of Japies Rus) of the Farm Magoloring 668, Portion 5 (A portion of Marthaspoort) of the Farm Magoloring 668 and Portion 2 (A portion of Marthaspoort) of the Farm Mogoloring 668, near Postmasburg in the Northern Cape The proposed development project is located on the western limb of the Postmasburg Manganese Field. This area has been characterized by low-medium grades manganese (<44%Mn). The area was previously mined by Associated Manganese Mines of South Africa (Assmang) Ltd in the 1960-mid 1980's. Assmang ceased their operations in the area after the discovery of high grade manganese (>44% Mn) on the Kalahari Manganese Field to the north and the mine was abandoned. No rehabilitation was undertaken after Assmang ceased their operations and large volumes of stockpiles and open-pits still remain on site.

Prospecting activity has been carried out on the property to determine the resource reserve and distribution. This information has been carried forward to guide the mine work programme. Results from the drilling and subsequent prospecting indicated that the majority of the resource at the Emang Manganese Project lies within 30 meters of the surface and is likely to be amenable to shallow open pit mining with a low waste to ore ratio. In order to undertake mining related activities an environmental authorization process is required.

The Study Area

The Emang Mmogo project is located in the Northern Cape Province of South Africa, approximately 30km north of Postmasburg. The Manganese deposits of the Emang project belong to the bixbyite rich Western Manganese Belt of the Postmasburg Manganese Field. The topography is mountainous with high open hills and ridges. The study area falls with the Ag & Ib, land types, a land-type being an area that is uniform with respect to terrain form, soil patterns and climate. The area is described as non-arable low potential grazing land. The grazing capacity is between 16 -29 ha per LSU. Most of the area immediately surrounding the study area is also subject to mining projects. The other land use is extensive domestic

stock farming. The study area falls with three vegetation types, Kuruman Mountain Bushveld, Kuruman Thornveld and Olifantshoek Plains Thornveld. The area has been subjected to previous mining activity that was not rehabilitated and consequently waste dumps and open pits cover much of the study area. Most of the disturbed areas have been re-colonised by vegetation. Although bare patches of exposed substrate are evident, there are many small trees and shrubs through the area. The vegetation within the disturbed areas is however considered secondary in nature.

There is the potential that some faunal species of conservation concern may occur within the study area. The study area lies within the Lower Vaal Water Management Area. There is a non-perennial water course in the center of the study area. The groundwater table depth in the area ranges between 13.66 and 60.5 mbgl. In general water quality in the area is within the standards for domestic use, there are some areas that have high manganese concentrations. This can be associated with the natural occurrence of manganese in this area. The levels of N03-N concentration in some areas are also high which could be related to livestock farming activities.

No post-Stone Age/colonial era heritage traces were noted to occur within the study area,
No heritage traces of the nineteenth-twentieth century were noted in the area.
Numerous mining related activities exist in the area to the south and north of the project area. The undulating nature of the terrain within the proposed mining area however limits the extent of visual intrusions. The area has already been disturbed by previous mining activity the result is a landscape with a fairly poor sense of place and a moderate to low scenic quality.
The most important employer in the Municipal Area is the mining sector.

Please refer to Figure 2: The locality of the proposed Emang Mmogo open cast mine).

Legislative requirements

National Environmental Management Act, 1998 (Act 108 of 1998) [as amended)
The proposed mine development and operations requires compliance with the EIA Regulations of 2010, promulgated in terms of the National Environmental Management Act, Act 107 of 1998 (as amended). The proposed activity requires a Scoping and EIA process as

listed activities 9, 11, 13, 18, 22, 37, 47 & 53 under Government Notice No R. 544 as well as listed activities 15 and 20 of Government Notice No R. 545 of the EIA 2010 Regulations are triggered.

National Water Act, 1998 (Act 36 of 1998)

The proposed mine development and operations further also requires compliance with the National Water Act, 1998 (Act 36 of 1998). An application for an integrated water use licence in terms of Section 21 to undertake the following activities will be applied for:

(a) taking water from a water resource;

(b) storing water;

(c) impeding or diverting the flow of water in a watercourse;

(i) altering the bed, banks, course or characteristics of a watercourse;

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

The requirements of the following legislation have also been considered in this Application for environmental authorisation:

- Constitution of South Africa (Act No. 108 of 1996);
- National Biodiversity Act (Act No.10 of 2004);
- National Environmental Management Air Quality Act (Act No. 39 of 2004);
- National Environmental Waste Management Act (Act No. 59 of 2008);
- National Heritage Resource Act (Act No. 25 of 1999);
- National Forest Act (Act 84 of 1998);
- Conservation of Agricultural Resources Act (Act 43 of 1983);
- Minerals and Petroleum Resources Development Act (Act No. 28 of 2002); and
- Occupational Health and Safety Act (Act No. 85 of 1993).

Alternatives

Alternatives are defined in the NEMA EIA Regulations (2010) as “different means of meeting the general purpose and requirements of the activity, which may include alternatives to: (a) the property on which or location where it is proposed to undertake the activity; (b) the type of activity to be undertaken; (c) the design or layout of the activity; (d) the technology to be used in the activity; and (e) the operational aspects of the activity and (f) the option of not implementing the activity”.

For the purpose of this application, the following Alternatives will be considered:

- Mining methodology alternatives);
- Mineral Processing Methods);
- Transport Power, and Water Supply;; and
- Proceed without the mine (No – Go alternative).

PUBLIC PARTICIPATION

Public participation is one of the most important aspects of the environmental assessment process. As previously mentioned, before a decision on the application for the proposed Emang Mmogo open cast mining project can be obtained, the project needs to undergo a full Scoping/EIA process. Public Participation forms a key component of each phase and the activities completed as part of the Scoping and EIA phase will be reported on in this report. A comprehensive public participation process was followed by JOMELA and as such the project was announced as follows:

- Publication of a media advertisement in the Diamonds Fields Advertiser DFA and the Kalahari Bulletin on the 14 June and 11 June 2013 respectively;
- On-site notices, advertising the EIA were placed along the border of the Farm property;
- Distribution of letters by fax/post/email to I&APs
- Distribution of Registration and Comment sheets by fax/post/email to I&APs

All the issues raised by I&APs to date were captured in the Comment and Response Report

All comments on the Scoping Report were incorporated into the comments and Responses Report which formed part of the appendices for the Final Scoping Report.

Public participation during the Environmental Impact Assessment Phase of the EIA revolved around a review of the comments received during the Scoping Phase, comments received during the public meeting, findings of the EIA and inputs into the Environmental Management Plan (EMP). The findings were presented in a Draft Environmental Impact Assessment Report and EMP and the volume of specialist studies. The Draft EIA report was made available for public review.

The draft Environmental Impact Assessment Report will be made available for public review for a period of approximately four weeks (excluding school holiday) from the 13th of November 2014. The availability of the Environmental Impact Assessment Report was announced as follows:

- An advert announcing the availability of the draft Environmental Impact Assessment Report was placed in the Postmasburg Register on the 20th of October 2014 and in the Diamond Fields Advertiser on the 22nd of October 2014 , approximately 2 weeks prior to the availability of the report;
- A hard copy of the draft Environmental Impact Assessment Report was placed at the Postmasburg Public Library;
- An electronic copy of the draft Environmental Impact Assessment Report was posted on the JOMELA website at http://www.Jomela.co.za;

All the issues raised by I&APs during the EIA phase will be captured in the Comment and Response Report and the I&APs will receive letters acknowledging their contributions.

Public Open House/Public Meeting

A Public Open House was conducted at the Tsantsabane Community Hall on the 13th of November 2014.

The purpose of the Open House was to:

- Describe the project and the process followed to date;
- Explain the motivation for the project;
- Indicate the study area and orientate attendants;
- Indicate the issues already identified through the public participation and bio-physical studies;
- Note new issues, concerns, questions and statements;
- Answer questions and explain concepts, and
- Register new Interested and affected parties (I&APs).

The objectives of the Public Open House were therefore to visually present the contents of the EIA Report and EMP; in order for I&APs to contribute issues of concern and/or suggestions for enhanced benefits and to contribute local knowledge

to the project. I&APs will have the opportunity to meet with members of the Project Team and Environmental Impact Assessment (EIA) Technical Specialists to discuss any questions they may have in the language of their choice. All comments raised during the Open House have been included in the Comment and Response Report.

SCOPING AND ENVIRONMENTAL IMPACTS

The Scoping exercise concluded that the main aspects which required further investigation were the potential impacts on:

Water Resources:

- Increase in watercourse sedimentation, erosion and general pollution of surface water resources; and
- The quantity of groundwater resources:
    - Depletion of the underground aquifer; and
    - Pollution of groundwater resources due to seepage from open cast Manganese and Iron mining activities.

Air Quality:

- Dust levels and related health impacts from the generation of dust.

Destruction of Sensitive Flora and Fauna:

- The ecological *status quo* of the Emang Mmogo area;
- Riparian areas on site and in the surrounding area;
- The dispersal of existing flora and fauna on site by means of existing water channels; and
- Spill-over impacts, which may occur on adjacent ecological systems.

Soils and Land-use Capability:

- Loss of soil resources for agricultural land uses;
- Soil degradation as a result of mining activities; and
- The utilization of soil resources for inappropriate land uses backfilling cut areas.

Noise vibration and shock:

- Increase in the ambient noise level as a result of blasting activities,
- The disruption of current ambient noise levels; and
- The disruption of sensitive receptors by means of increased noise and vibration.

Socio-economic:

- The determination of the extent to which the current social *status quo* will be altered and if so, the manner in which such changes will occur.

Visual Impact:

- The visual character of the area as a result of the establishment of mining infrastructure such as a Manganese and Iron ore dump.

Traffic:

- The change in the traffic patterns as a result of traffic entering and exiting the Emang Mmogo open cast Manganese and Iron mine on the surrounding road infrastructure and existing traffic.

Job Creation:

- 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.

The above mentioned key issues and potential impacts; identified during the Scoping phase; were together with potential cumulative impacts, assessed during the Environmental Impact Assessment phase of the project and appropriate mitigation measures to reduce the identified impacts as far as possible were proposed. The summary of the significance of

identified impacts before and after mitigation is given in the table below:

Table 1: A summary of the significant impacts identified during the Scoping phase and assessed during the EIA phase of the project

Environmental Aspect	Significance Without Mitigation	Significance With Mitigation
Impacts on groundwater levels	Low to Medium	**Low to Medium**
Impacts on groundwater levels due to the dewatering of the open pit	Medium	**Medium**
Contamination of surface and groundwater resources due to the migration of contaminated water from the mining operations	Medium	**Medium**
Pollution of surface water due to construction and operation activities	Low	**Low**
Altered Hydrological Regime	Medium to High	**Medium**
Atmospheric pollution	Low to Medium	**Low**
Impacts on Rare and Endangered Fauna and Flora	Low to Medium	**Low**
Destruction of Natural Habitat	Low to Medium	**Low**
Reduction of Natural Migratory Routes	Low to Medium	**Low**
Noise and Vibration	Low to Medium	**Low**
Visual impacts	Medium	**Medium**
Soil Erosion and Surface runoff	Low	**Low**
Soil Pollution	Low	**Low**
Heritage resources	Low to Medium	**Low**
Socio-economic environment – job creation	**High Positive**	**High Positive**

Based on the impact assessment and the results of the various specialist studies, it is believed that the proposed development will not result in any fatal flaws in terms of the

environment that could warrant stopping the development from proceeding. Provided that the correct mitigation measures are implemented in accordance with the Environmental Management Plan (EMP), impacts that would potentially have a significant negative effect on the environment will be minimised to medium and low impacts.

- The groundwater system as well as ground and surface water quality is monitored and models and assessments updated as more information becomes available;
- Rehabilitation and monitoring plan should be developed to ensure the success of Riparian re-establishment. Furthermore, every effort should be made to prevent the impact on the remaining Riparian on the study site;
- Blasting vibrations should be controlled by means of optimising blasthole geometry and altering the time of blasting;
- Implementation of a dust and noxious gases' minimisation strategy that will reduce the impact of atmospheric pollution be undertaken. This strategy will include the use of noxious gas fixation techniques, using and adhering to blasting schedules, and strategies that minimize dust generation;
- The building textures and colours should blend in with the backdrop of colour and textures provided by the landscape. The natural setting and colours of buffs, olive greens, dark browns should be respected and where possible, these should be incorporated into the materials used in the exteriors of the building and landscape;
- Colours of new infrastructure should be matt and not glossy, so as to reduce reflection and glare from the surfaces. This is important when considering the night scene and reflected light;
- Disturbed surfaces must be ripped, and the area must be backfilled with topsoil or overburden and appropriately re-vegetated when rehabilitation commences;
- The topsoil layer must be retained and used in facilitating the reinstatement of indigenous vegetation;
- By maintaining the maximum amount of vegetated area on site, the extent of erosion and ecosystem loss can be contained;
- An ecologically-sensitive storm water management plan should be implemented during the construction phase;
- Dust fallout monitoring should be carried out close to the sensitive receptors around the mine area and in the proposed site for the operational activities. It is

recommended that dust deposition monitoring be confined to sites within, and in close proximity (<2 km) to the proposed mine operations. Monitoring should be undertaken using the American Society for Testing and Materials standard test method; for the collection and analysis of dustfall (ASTM D-1739) or any other method which can demonstrated to give equivalent results (SANS, 2004). Dust fallout at the sensitive receptor sites should be below 600 mg/m²/day at all times;

- No blasting with explosives or heavy drilling within 20 meters of any heritage feature may occur;
- It is recommended that an existing community based organisation and non government organisation in the surrounding area be used to serve as a communication channel between the community and Emang Mmogo(Pty) Ltd ; and
- Labour guidelines should be drafted in terms of employing local residents as it is expected that there will be an influx of newcomers in search of employment.

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LIST OF ABBREVIATIONS

APCS	-	**A**ir **P**ollution **C**ontrol **S**ystem
DEAT	-	**D**epartment of **E**nvironmental **A**ffairs and **T**ourism
DME	-	**D**epartment of **M**inerals and **E**nergy
DWA	-	**D**epartment of **W**ater **A**ffairs
EA	-	**E**nvironmental **A**uthorisation
ECA	-	**E**nvironment **C**onservation **A**ct, 1989 (Act No. 73 of 1989)
ECO	-	**E**nvironmental **C**ontrol **O**fficer
EMP	-	**E**nvironmental **M**anagement **P**lan
EIA	-	**E**nvironmental **I**mpact **A**ssessment
EAP	-	**E**nvironmental **A**ssessment **P**ractitioner
EMS	-	**E**nvironmental **M**anagement **S**ystem
GIS	-	**G**eographical **I**nformation **S**ystem
GN	-	**G**overnment **N**otice
HVAC	-	**H**eating, **V**entilating and **A**ir **C**onditioning
HIA	-	**H**eritage **I**mpact **A**ssessment
I&APs	-	**I**nterested and **A**ffected **P**arties
IEM	-	**I**ntegrated **E**nvironmental **M**anagement
Ktpm	-	**K**ilo **T**on **P**er **M**onth
Mt	-	**M**ega **T**onnes
NEMA	-	**N**ational **E**nvironmental **M**anagement **A**ct, 1998 (Act No. 107 of 1998)
NWA	-	**N**ational **W**ater **A**ct
NGO	-	**N**on-**G**overnmental **O**rganisations
PM10	-	**P**articulate **M**atter of less than 10µ
PPP	-	**P**ublic **P**articipation **P**rocess
PoS	-	**P**lan **o**f **S**tudy
RBTC	-	**R**ichards **B**ay **Manganese and Iron T**erminal
SAHRA	-	**S**outh **A**frican **H**eritage **R**esources **A**gency
JOMELA	-	**Jomela Consultants**(Pty) Ltd
SHEQ	-	**S**afety **H**ealth **E**nvironmental **Q**uality
WULA	-	**W**ater **U**se **L**icence **A**pplication

GLOSSARY OF TERMS

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. 387.

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

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

Environmental Impact Assessment: Assessment of the effects of a development on the environment.

Environmental Management Plan: 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.

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

1. INTRODUCTION

Jomela Consultants (Pty) Ltd, as independent environmental consultants and assessment practitioners, have been appointed by Emang Mmogo Mineral Resources (Pty) Ltd to facilitate the Environmental Impact Assessment (EIA) procedure for the proposed open cast mining on Portion 4 (A portion of Japies Rus) of the Farm Magoloring 668, Portion 5 (A portion of Marthaspoort) of the Farm Magoloring 668 and Portion 2 (A portion of Marthaspoort) of the Farm Mogoloring 668. (Refer to Figure 2).

The proposed development project is located on the western limb of the Postmasburg Manganese Field. This area has been characterized by low-medium grades manganese (<44%Mn). The area was previously mined by Associated Manganese Mines of South Africa (Assmang) Ltd in the 1960-mid 1980's. Assmang ceased their operations in the area after the discovery of high grade manganese (>44% Mn) on the Kalahari Manganese Field to the north and the mine was abandoned. No rehabilitation was undertaken after Assmang ceased their operations and large volumes of stockpiles and open-pits still remain on site.
Portion 4 (A portion of Japies Rus) and Portion 5 (A portion of Marthaspoort) of the farm Magoloring 668 is currently owned by Assmang however Emang Mmogo Mining Resources are currently in negotiations with Assmang for the surface rights of the property. Portion 2 (A portion of Marthaspoort) of the farm Magoloring 668 is owned, Mr Awie Claassens. Emang is also in negotiations with the property owner to lease this farm portion for the proposed mining development.

The Emang Mmogo open cast mining project entails the mining of Manganese and Iron residues utilising the roll over method of mining. As required by the National Environmental Management Act (NEMA), 1998 (Act No 107 of 1998), a Scoping and Environmental Impact Assessment (EIA) must be undertaken before the proposed activity can be commissioned.

1.1 DETAILS OF THE APPLICANT AND ENVIRONMENTAL ASSESSMENT PRACTITIONER

The details of the project applicant are indicated as follows.

Table 2: Details of the Applicant

Details of the Applicant	
Company Name:	Emang Mmogo Mining Resources (Pty) Ltd
Company Reg. No.:	2007/007820/07
Postal Address:	P. O. Box 716 Hartswater 8570
Physical Address:	Office No. 4 & 5 Eric Louw Street Empetus Building Hartswater 8570
Contact Person:	Mr. Godfrey Mfetoane (CEO)
Mobile Number:	(+27) 82 698 7819
Office Tel/Fax	053 474 0596
Email Address:	info@kolong.co.za

Table 3: EAP Details

COMPANY:	**JOMELA CONSULTING (PTY) LTD**
COMPANY REG. NO.:	2013/023450/07
POSTAL ADDRESS:	P. O. Box 415 Celtis Ridge Centurion 0130
CONTACT PERSONS:	Cecil Khosa Phathutshedzo Mugagadeli
CONTACT NUMBER:	(+27) 12 772 2350 (+27) 79 855 9666
FACSIMILE:	(+27) 86 626 4839
EMAIL:	cecilkhosa@jomela.co.za environment@jomela.co.za

Jomela Consulting (Pty) Ltd was established in 2013. The company was established with a view to join efforts of various associate specialists to provide a one-stop environmental management service. The associates bring collectively to the company a wealth of

experience and skills obtained through qualifications, work experience and also interactions over the years with different stakeholders such as industry, government and civil society. This experience and skill in environmental management ranges from policy analysis and development, regulatory compliance and enforcement, environmental impact assessment, development and/or review of environmental management plans.

The associates constituting Jomela Consulting have previously worked for the government and private sector both in the mining and environmental sectors. In terms of qualifications these associates are all degreed professionals with registrations and affiliations with the SACNASP, GSSA and EAPSA.

1.2 LEGAL REQUIREMENTS

The aim of this component of the report is to provide a brief overview of the pertinent policies as well as legal and administrative requirements applicable to the proposed development.

Emang Mmogo is applying for environmental authorisation (EA) in terms of the National Environmental Management Act, 1998 (Act no 107 of 1998) (as amended) [NEMA] and the Environmental Impact Assessment (EIA) Regulations of 2010 (Government Notice No's R 543, 544 and 545 in Government Gazette No. 33306 of 18 June 2010) for the construction and operation of coal mine.

NEMA strives to regulate national environmental management policy and is focussed primarily on co-operative governance, public participation and sustainable development. NEMA makes provisions for co-operative environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by Organs of State and to provide for matters connected therewith.

The proposed construction and operational activities associated with the Manganese and Iron mine falls within the ambit of the scheduled activities listed in Government Notice (GN) No. 544 and 545 (Refer to Table 3 below). A full Scoping and EIA process must be undertaken in terms of the requirements stipulated in GN. No. 543.

1.2.1. Environmental Impact Assessment Requirements

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

Table 4: Listed activities applied for.

GOVERNMENT NOTICE	ACTIVITY	ACTIVTIY DESCRIPTION and PROJECT RELEVANCE
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	9	Construction of a storm water management system in and around the mine, as well as pipe lines for the movement of water from one area of the mine to another.
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	13	Storage of explosives for blasting, and fuel for mine equipment.
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	11	The construction of mine buildings and infrastructure exceeding 50 square metres in size, in close proximity to watercourses as well as bridges, canals and channels.
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	18	Movement of soil and material from watercourses and in close proximity to watercourse
National Environmental Management Act, (Act 107 of 1998) GN.R. 544, 18 June 2010	22	The construction of a roads and access routes within the mining area.
National Environmental Management Act, (Act 107 of 1998) GN.R. 545, 18 June 2010	5	The construction of pollution control facilities such as pollution control dams, tailings dumps and ore stockpiles.
National Environmental	10	The construction of facilities or infrastructure for the

Management Act, (Act 107 of 1998) GN.R. 545, 18 June 2010		transfer of water i.e. pumping of underground fissure water and transfer to a waste water containment area.
National Environmental Management Act, (Act 107 of 1998) GN.R. 545, 18 June 2010	15	Construction of mine facilities and associated infrastructure.
National Environmental Management Act, (Act 107 of 1998) GN.R. 545, 18 June 2010	20	Undertaking of mining activities.
National Environmental Management Act, (Act 107 of 1998) GN.R. 546, 18 June 2010	13	Earth moving activities and the clearance of vegetation cover.
National Environmental Management Act, (Act 107 of 1998) GN.R. 546, 18 June 2010	14a	The clearance of vegetation.

Therefore, according to the above activities, this application requires a Scoping and EIA application.

1.2.2. Other Legal Requirements

Constitution of the Republic of South Africa (Act No. 108 of 1996)

The Constitution of the Republic of South Africa (Act No. 108 of 1996) has major implications for environmental management. The main effects are the protection of environmental and property rights, the drastic change brought about by the sections dealing with administrative law such as access to information, just administrative action and broadening of the *locus standi* of litigants.

These aspects provide general and overarching support and are of major assistance in the effective implementation of the environmental management principles and structures of the ECA and NEMA. Section 24 in the Bill of Rights of the Constitution specifically states:

"Everyone has the right -

- To an environment that is not harmful to their health or well-being; and
- To have the environment protected, for the benefit of present and future

generations, through reasonable legislative and other measures that -

- Prevent pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

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

The National Water Act (NWA) guides the management of water in South Africa as a common resource. The Act aims to regulate the use of water and activities, which may impact on water resources through the categorisation of 'listed water uses' encompassing water extraction, flow attenuation within catchments as well as the potential contamination of water resources, where DWAF is the administering body in this regard.

The NWA aims to manage the national water resources to achieve sustainable use of water for the benefit of all water users. The purpose of the Act is to ensure that the nation's water resource are protected, used, developed, conserved and managed in ways, which takes into account:

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Redressing the results of past racial discrimination;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Providing the growing demand of water use;
- Protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources;
- Meeting international obligations;
- Promoting dam safety; and
- Managing floods and droughts.

The project will require the submission of a Water Use License Application (WULA) in terms of Section 21 of the NWA which will include the following activities:

21. A) Taking water from a resource;
    b) Storing water;

j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

I) Altering the bed, banks course or characteristics of a watercourse.

The WULA will be undertaken as a separate process and does not form part of this environmental authorisation process.

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

The National Heritage Resources Act legislates the necessity for a cultural and heritage impact assessment in areas earmarked for development that complies with one of the following:

Section 38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorized as-

(a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site-

(i) exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

The Atmospheric Pollution Prevention Act (Act No 45 of 1965) & the National Environmental Management: Air Quality Act (Act No 39 of 2004)

The objective of the Atmospheric Air Pollution Prevention Act, 1965 is to regulate air quality in order to protect, restore and enhance the quality of air in the Republic, taking into account the need for sustainable development. Furthermore, the provision of national norms and standards regulating air quality monitoring, management and the control by all spheres of government; for the specific air quality measures should be adhered to.

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

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed.

Promotion of Access to Information Act (Act No. 2 of 2000)

The Promotion of Access to Information Act (Act No. 2 of 2000) recognises that everyone has a Constitutional right of access to any information held by the state and by another person when that information is required to exercise or protect any rights. The purpose of the Act is to foster a culture of transparency and accountability in public and private bodies and to promote a society in which people have access to information that enables them to exercise and protect their rights.

1.2.3. Policies and Guidelines

Integrated Environmental Management (IEM)

IEM is a philosophy for ensuring that environmental considerations are fully integrated into all stages of the development process. This philosophy aims to achieve a desirable balance between conservation and development (DEAT, 1992). The IEM guidelines intend encouraging a pro-active approach to sourcing, collating and presenting information in a manner that can be interpreted at all levels.

1.3 SITE DESCRIPTION

1.3.1. Regional Context

Emang Mmogo Mining Resources (Pty) Ltd has submitted an application to the Department of Environment and Nature Conservation (DENC) for environmental authorization for the proposed establishment of an open-pit mine. The target minerals are Manganese (Mn) and Iron (Fe) ores. The property on which the application has been made is Portion 4 (A portion of Japies Rus) of the Farm Magoloring 668, Portion 5 (A portion of Marthaspoort) of the Farm Magoloring 668 and Portion 2 (A portion of Marthaspoort) of the Farm Mogoloring 668, constituting a total area of approximately 1668ha.

The proposed development project is located on the western limb of the Postmasburg Manganese Field. This area has been characterized by low-medium grades manganese (<44%Mn). The area was previously mined by Associated Manganese Mines of South Africa (Assmang) Ltd in the 1960-mid 1980's. Assmang ceased their operations in the area after the discovery of high grade manganese (>44% Mn) on the Kalahari Manganese Field to the north and the mine was abandoned. No rehabilitation was undertaken after Assmang ceased their operations and large volumes of stockpiles and open-pits still remain on site.

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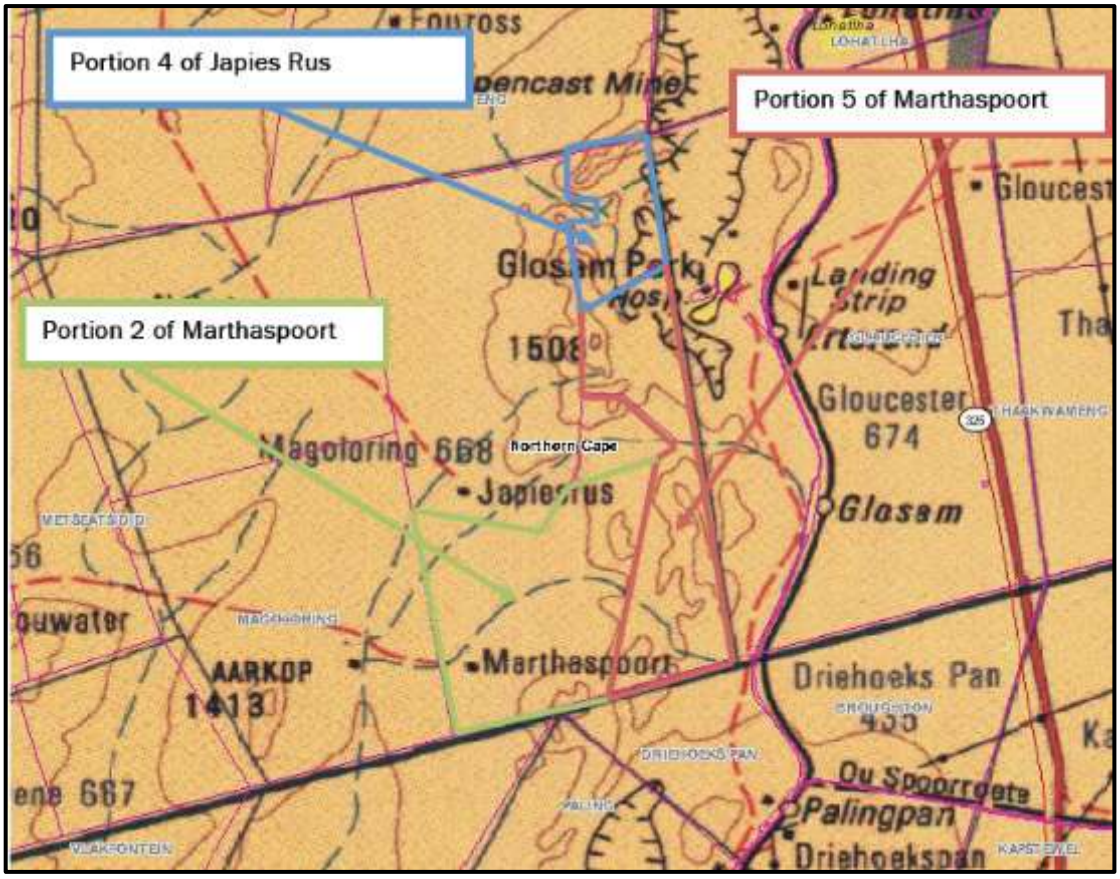

Figure 1: Portions delineation of the farm Magoloring 668.

1.3.2. Current Land use

No permanent homesteads are located within the proposed path of mining. The village of Glosam is located a kilometre west of the proposed mining area. The village was constructed for use by Assmang during their mining operations. The village of Lohatla is located north east of the site.

1.3.3. Community land ownership

No community landownership exists within the project area. Surface rights of the project area are currently held by mining companies and a commercial farmer. No land claims are relevant for the study area.

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1.3.4. The Site

The Emang Mmogo project is located in the Northern Cape Province of South Africa, approximately 30km north of Postmasburg. The property is readily accessible from the R325, which is a tarred, provincial road leading from Kathu to Postmasburg. A gravel road provides access from the R325 to the village of Glosam. The village of Lohatla is located north east of the site.

The railway line from Sishen to Postmasburg is situated directly east of the properties. The Ertsrand railway siding is approximately 2.2km southeast of the project area. The Gamagara water pipeline passes the study site west of the R325.

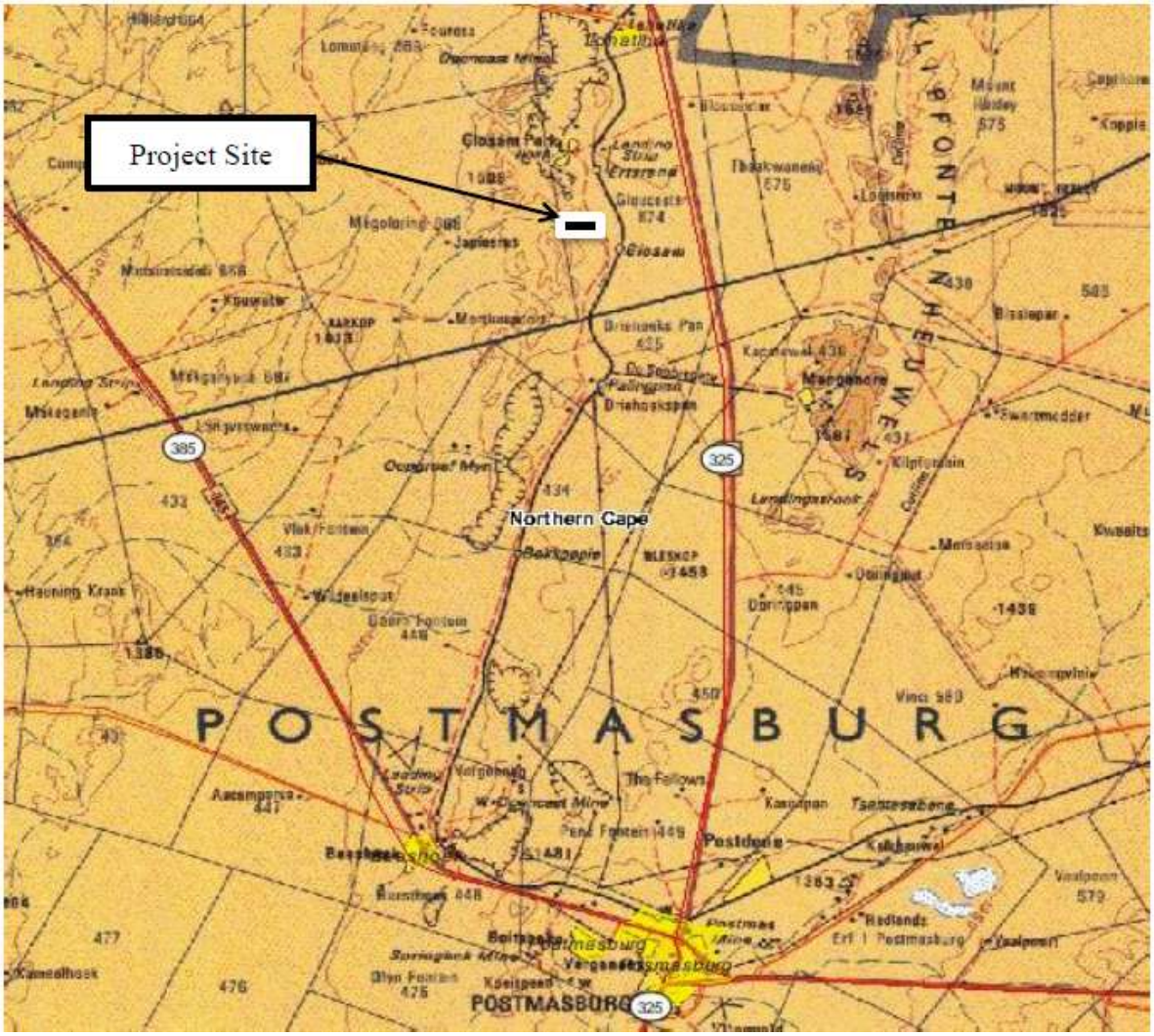

Figure 2: The locality of the proposed Emang Mmogo open cast mine

1.4 PROJECT DESCRIPTION

The project will involve the development of an open cast mining operation. The conceptual locations of the proposed surface infrastructure component layout are presented in Figure 3 below. The ore will be mined from an open pit section using conventional truck and shovel methods. Ore will be drilled and blasted in the open pit section, loaded onto haul trucks and transported to a crushing site. After crushing the ore will then be stockpiled and processed. The finished product will be transported off-site by rail and trucks.

The proposed support facilities that will be required include:

- contractors laydown areas;
- temporary handling and storage area for construction materials (paints, solvents, oils, grease);
- temporary storage area for non-mineralized waste prior to removal by appropriate contractor;
- temporary water supply will be supplied by borehole and/or trucks;
- power supply will be by temporary diesel-powered electricity generator;
- workshops and wash bays;
- fuel handling and storage area;
- temporary offices and temporary chemical toilets; and These facilities would either be removed at the end of the construction phase or incorporated into the layout of the proposed infrastructure.

The total construction worker compliment over the construction phase is approximately 50 people. The construction workers will be housed offsite and transported to the site by the construction company. Prefab toilets and showers will be provided for the construction workers on site. General waste will be sorted and stored before being trucked off site and disposed of at an appropriate waste facility. The construction company will be responsible for disposing of waste generated as a result of the construction camp operations.

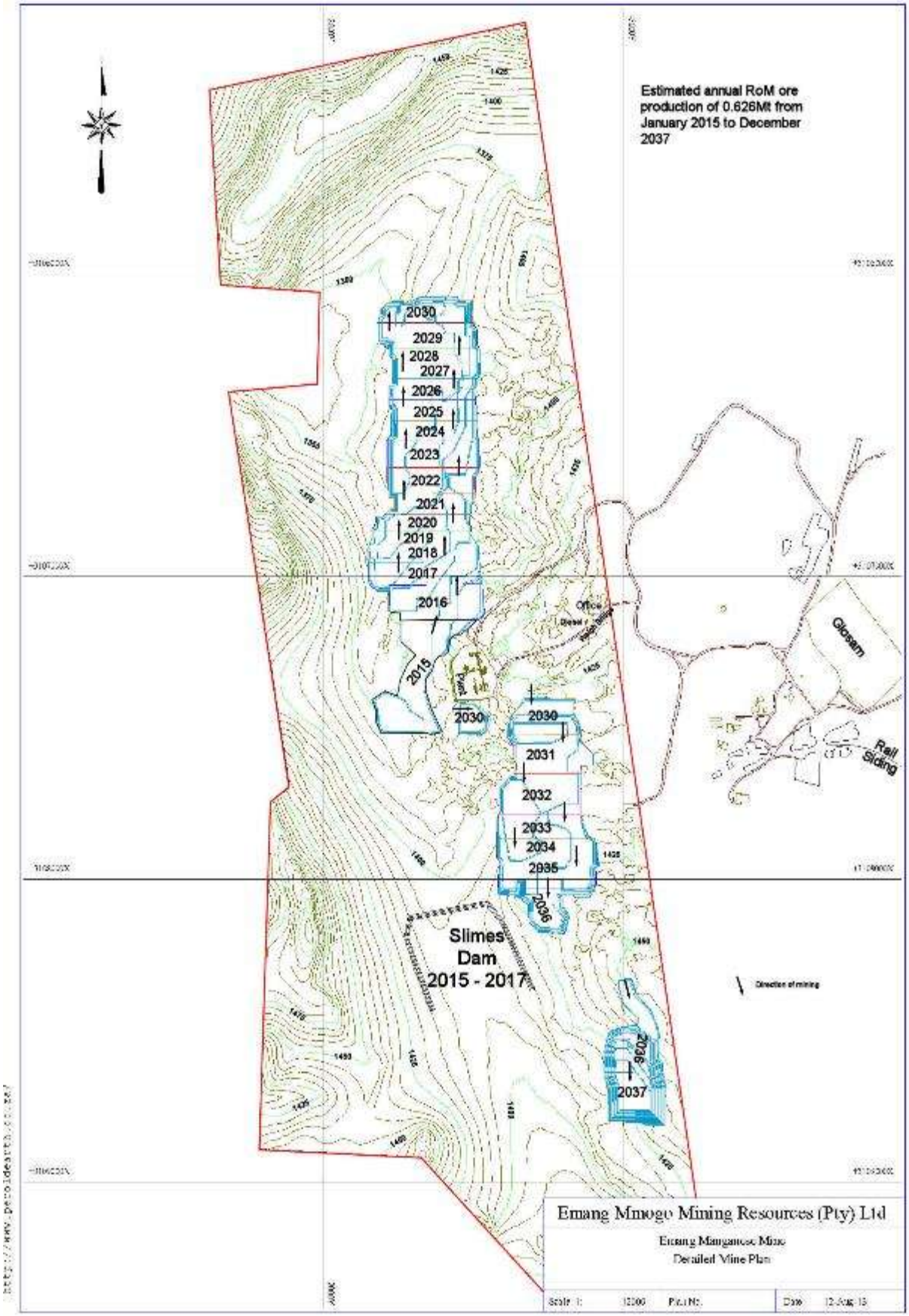

Figure 3. Proposed Emang Mmogo Mining area and associated infrastructure

The life of the mine is anticipated to be 23 years. The envisaged mining method will consists of drilling (76mm blast holes), blasting (slurry with boosters) and loading and hauling to the primary crusher. The drilling and blasting will be outsourced to competent blasting contractors. Blasting patterns for overburden/ waste and RoM (run of mine) ore will differs as follows:

- Overburden/waste: 3 x 3.5 meter burden and spacing
- RoM ore: 3 x 3 or 3 x 2.5 meter burden and spacing

Blasted waste rock will be loaded, by excavators, onto 30 ton articulated dump trucks and utilized in the construction of walls for the slimes dam during the first 3 months of overburden stripping. Any excess waste rock mined during the first three months will be dumped onto a waste dump situated to the immediate west of the box cut. All waste material mined after the initial 3 month period will be backfilled into mined out section of the opencast pit as an ongoing rehabilitation programme.

All seed bearing soil overlying competent rock will be dozed into heaps, prior to drilling and blasting, loaded and transported to topsoil dumps at various points to the west of the pit as mining progresses. This material will be used to re-establish vegetation once mined-out sections have been backfilled and profiled to the satisfaction of the mine manager and representatives of the DMR.

Blasted RoM ore will be loaded by excavator and hauled to the primary crusher for processing. All load and haul operation will be outsourced to a competent mining contractor who has to keep the following fleet:

- 3 excavators
- 9 articulated dump-trucks
- hydraulic rock hammer
- Ancillary Equipment kept on site will includes a grader, water cart and a bulldozer.

Samples will be taken from the blast holes and analyzed for Mn and Fe prior to blasting. These composite results will be used for grade control to distinguish between internal waste and RoM ore (Mn ≥ 16%).

Big C Rock Engineering assessed the slope stability of the proposed opencast pit and came to the following conclusion and recommendations for pit design:

- The overall slope angle used must be 55**°**
- Bench geometry used in the pit design are:
    - Bench Height–13meters
    - Berm Width–7.02meters
    - Bench Face angle–70 **°**
- All new ramps were designed to a final width of 20 meters with a 1:10 gradient.

Processing

RoM ore (-200 mm) with an average feed grade of 21.65 % Mn will be reduced by the primary crusher to -60mm. Oversize RoM ore from the feeder grizzly will be broken by a hydraulic rock hammer and added to the crusher feed with a front-end loader. Crushed ore will be fed to a 60mm vibratory screen. Oversize (+60mm) material will be returned to the primary crusher while under size ore (-60mm) will be stockpiled for further processing.

The -60mm ore will be fed via a conveyor to a single deck (dry) vibratory 20 mm screen. The oversize ore (-60 + 20 mm) will be stockpiled as lumpy manganese product (estimated grade of +28% Mn and estimated recovery yield of 35%) while the -20mm ore will be drawn from beneath using a direct feeder onto an underground conveyor for VSI (Vertical Spindle Impact) crushing to -1.6 mm. Crushed material will then be directly fed to a de-sliming cyclone where slimes (22%) are removed and pump to a slimes dam.

Estimated water consumption is anticipated to be 0.3m3/t or 311 000 m3 annually. The de-slimed material will be fed to a fines medium separator for removal of tailing

to a stockpile. Stockpiled tailing will be loaded by a front-end loader and hauled to a mined out section of the pit for profiling of areas backfilled with waste rock while the concentrated product will be compressed into briquettes (estimated grade of +32% Mn and estimated recovery yield of 42%).

Current planning is to operate the slimes dam for the first three years of production after which slimes will be redirect to a worked out section from the mine. Material in the slimes dam will also be loaded and used for rehabilitation purposes

The Emang Mmogo operation proposes to use the rollover mining and rehabilitation method once formal mining operations commence. Sustainable development applied to mining works necessarily includes rehabilitation with the aim of either restoring the land to its original use, or eliminating or reducing adverse environmental impacts to a long-term acceptable condition. The process is driven primarily by legislation which ensures that the mine owner must comply with the intention of achieving those end conditions, which are defined in broad terms by guidelines.

1.4.1. Rollover mining and rehabilitation method

Figure 4 is a graphic representation of the rollover method. The stripping and stockpiling of topsoil is the most important step in any rehabilitation program and must begin before any minerals are extracted from the intended area of disturbance. Prior to the commencement of minerals extraction, the site will be cleared and grubbed. Then all topsoil located in the area of disturbance will be stripped from the site, avoiding mixing with trees, boulders and other discard materials, and will be stockpiled in berms located outside the boundaries of the proposed operations for use at later mining phases.

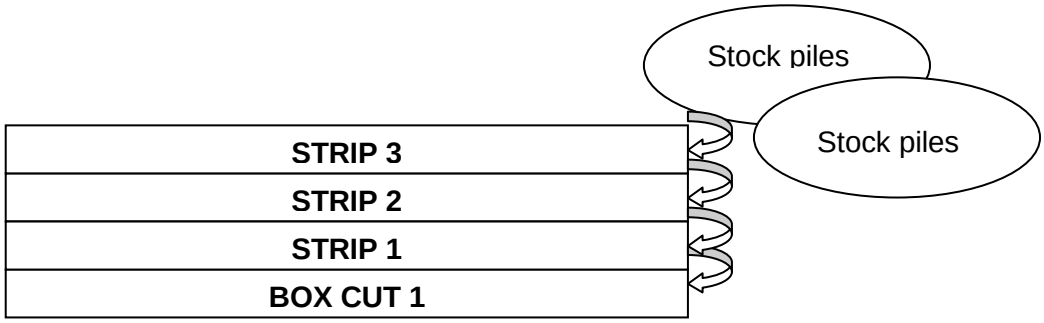

Figure 4: Diagram illustrating roll-over Manganese and Iron mining methodology

The following basic principles of rehabilitation form the basis of the roll-over mining method:

- Prepare a rehabilitation plan prior to the commencement of mining;
- Agree on the long-term post - mining land use objective for the area with the relevant government departments, local government councils and private landowners. The land use must be compatible with the climate, soil, topography of the final landform and the degree of the management available after rehabilitation;
- Progressively rehabilitate the site, where possible, so that the rate of rehabilitation is similar to the rate of mining;
- Prevent the introduction of noxious weeds and pests;
- Minimise the area cleared for mining and associated facilities to that absolutely necessary for the safe operation of the mine;
- Reshape the land disturbed by mining so that it is stable, adequately drained and suitable for the desired long-term land use;
- Minimise the long-term visual impact by creating landforms which are compatible with the surrounding landscape;
- Reinstate natural drainage patterns disrupted by mining wherever possible;
- Minimise the potential for erosion by wind and water both during and following mining;
- Characterise the topsoil and retain it for use in rehabilitation. It is preferable to reuse the topsoil immediately rather than storing it in stockpiles. Only discard if it is physically or chemically undesirable, or if it contains high levels of weed seeds or plant pathogens;
- Consider spreading the cleared vegetation on disturbed areas;
- Deep rip compacted surfaces to encourage infiltration, allow plant root growth and key the topsoil to the subsoil, unless subsurface conditions dictate otherwise;
- Ensure that the surface one or two metres of soil is capable of supporting plant growth;
- If topsoil is unsuitable or absent, identify and test alternatives substrates, e.g. overburden that may a suitable substitute after addition of soil improving substances;

- Re-vegetate the area with plant species consistent with the post mining land use; and
- Monitor and manage rehabilitation areas until the vegetation is self-sustaining.

Rehabilitation guidelines during the decommissioning phase should adhere to the following guidelines:

Site grading

The local environment in un-rehabilitated disturbed mining areas is unfavourable to vegetation establishment. Lack of topsoil, combined with uneven and often quite steep slopes hinders plant germination and establishment. While the disturbed slopes are being graded, care must be taken to ensure proper drainage of the site. Consideration should at this time be given to the creation of berms at the pit entrance, to screen the site and to prevent further unauthorized access.

Spreading of stored topsoil

Once the disturbed area's – box cuts as well as the new pit area - backfilling, grading and sloping is complete, subsoil and topsoil from storage berms located outside the mining area should be spread on the slopes as evenly as possible. When this has been completed, the next stage in the rehabilitation program should immediately commence to prevent erosion and topsoil loss.

Decommissioning and closure will entail the following:

- Slope and whaleback the slopes of both the old box cuts as well as the new pits to a gradient of at least 1:6, in order to accommodate any future agricultural activities within the area;
- The topsoil will be stockpiled as detailed in the previous section;
- Topsoil will be spread out over prepared areas to a depth of no less than 300mm, unless otherwise stated (see the 'topsoil stockpiling' section above);
- Neat stockpiling of oversized rock in the one corner of the pit or alternatively clustering rocks on long slopes with gradients of 1:6 to reduce erosion through

water run-off and facilitate plant growth by providing seedlings and seeding of the disturbed area;

- Remove the concrete/impermeable floor where refueling occurred;
- Remove all containers;
- Decontaminate any hydrocarbon spills by removing the soil and disposing of it at a licensed disposal facility;
- Remove the temporary fencing;
- Maintain the area by doing regular site inspections ensuring the establishment of vegetation and the eradication of alien invader species; and
- Reinstate natural drainage patterns disrupted by mining wherever possible.

All of the topsoil must be utilised as a growing medium in the rehabilitation process of the site, in other words it must be spread over all prepared areas (ripped to a depth of 300mm and sloped) and be re-vegetated with seeds found within the area or prepared in such a way as to satisfy the agricultural requirements of the area and/or the land owner.

It is imperative that rehabilitation occurs concurrently with mining activities, as topsoil, containing seeds from plants within the area, degrades over time with the result that the soil environment becomes unfavourable for germinating seeds.

1.4.2. Closure processes

The closure objective is to ensure that all the significant impacts have been mitigated against. All rehabilitated areas will be left in a stable, self-sustainable state. Proof of this will be submitted at closure.

The closure objectives for the Emang Mmogo open cast Manganese and Iron mine can be summarised as follows:

- Make all areas safe for both humans and animals;
- Make all areas stable and sustainable;
- Ensure impact on any water bodies, water courses and catchment areas have been avoided or minimised;
- Rehabilitate disturbed areas as soon as possible; and

- Minimise the impact on the local community.

With specific reference to the ground water environment, the following closure objectives should be pursued:

- Rehabilitation of the surface infrastructure where necessary to minimize infiltration into the underground water regime (the philosophy of concentration and containment); and
- Rehabilitation to minimise contamination of surface water resources (the philosophy of dilution and dispersion).

When and if necessary suitable structures and or systems are to be put, and kept in place to limit contamination of water resources to concentrations in accordance with the Target Water Quality Ranges for human consumption.

The goals upon decommissioning and closing of the Emang Mmogo open cast Manganese and Iron mine will include that all significant impacts have been mitigated and that there are no alterations to the environment that are apparent as far as is practically possible. All land will be rehabilitated to a state that facilitates compliance with current national environmental quality objectives including air quality objectives and water quality guidelines.

1.5 PROJECT MOTIVATION

The benefits of the proposed mining operation are discussed below,

The proposed mining operation will employ workers from within the borders of the Local Municipality. It is anticipated that the proposed mining operation will positively impact on the lifestyles of these individuals by providing them with a reliable source of income and implementing the Human Resource Development Plan as contained in the Social and Labour Plan.

It is anticipated that the mine will impact positively on the local-economy by appointing local procurement companies, as per the commitments contained in the Procurement Progression Plan contained in the Social and Labour Plan

The production and sale of iron ore manganese products by the proposed mining operation will contribute to the demand from South African consumers. There is also a possibility that the international market could be entered that will ensure a flow of foreign capital into the South Africa.

The proposed mining operation will impact positively on the un-rehabilitated areas within the boundaries of the proposed mining area caused by historical mining activities.

All mining infrastructure will be dismantled and removed at the end of life of mine. The existing dumps will be removed and historical opencast pits will be backfilled, rehabilitation of the dumps and open cast pits will occur on a continuous basis during the mining operations. The area will be landscaped and self-succession by natural vegetation will be encouraged.

1.6 ALTERNATIVE ASSESSMENT

The Integrated Environmental Management (IEM) procedure stipulates that the environmental investigation needs to consider feasible alternatives for any proposed development. Therefore, a number of possible proposals or alternatives for accomplishing the same objectives should be identified and investigated. During the EIA phase of the project, the various alternatives identified during the Scoping phase were assessed in terms of both environmental acceptability as well as economically feasibility. The following alternatives have been considered and highlighted in the EIA report:

- Mining method alternatives;
- Location alternatives;
- Input alternatives;
- Transport, Power And Water Supply Routes and
- Status quo / no-go alternatives.

1.7 FEASIBLE ALTERNATIVES

1.7.1. Input Alternatives

Various types of material can be used for the Emang Mmogo open cast mine's offices as well as other infrastructure on site. Although the suggestions are usually referring to residential construction; it will be possible to implement some of it into the construction of offices

These suggestions include but are not limited to the following:-

Energy effective building construction and orientation have not been considered to date. However, the following recommendations regarding structural designs are recommended by the environmental consultant:

- Use of building material that requires excessive amounts of energy to manufacture should be minimised;
- Use of building material originating from sensitive or scarce environmental resources should be minimised. E.g. no tropical hardwood may be used;
- Building material should be legally obtained by the supplier, e.g. wood must have been legally harvested, and sand should be obtained only from legal borrow pits and from commercial sources;
- Building material that can be recycled / reused should be used rather than building material that cannot; and
- Use highly durable building material for parts of the building that is unlikely to be changed during the life of the building is highly recommended.

During the facility design and development process, building projects must have a comprehensive, integrated perspective that seeks to:

- Reduce heating, cooling, and lighting loads through climate-responsive design and conservation practices;
- Employ renewable energy sources such as daylighting, passive solar heating, photovoltaics, and geothermal;
- Specify efficient HVAC (Heating, Ventilating and Air Conditioning) and lighting systems that consider part-load conditions and utility interface requirements;

- Optimise building performance by employing energy modelling programs and optimise system control strategies by using occupancy sensors and air quality alarms; and
- Monitor project performance through a policy of commissioning, metering, and annual reporting.

1.7.2. Location Alternative

Site alternatives do not form part of the discussion as the location of the mine is determined by the geological location of the mineral resource, the nature and extent of mineral resources in terms of the financial viability, with respect to the costs associated with mining of the ore body and its economic potential in terms of global markets.
Furthermore, the study area is defined by the limitations associated with the prospecting right as issued by the Department of Mineral Resources (DMR).

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1.7.3. Alternative Mining methods

In most mining projects, the alternative mining options are underground or open cast methods. The manganese deposit at the Emang Mmogo Manganese Project is believed to be irregular in shape as a result of formation through slumping of the Manganore Iron-Formation into paleo-sinkholes and given the depth to and nature of the ore body, the preferred method for the proposed development is open cast mining. Results from the 62 Reverse Circulation and 9 Diamond drills that were carried out during the prospecting process indicated that the majority of the resource at the Emang Manganese Project lies within 30 meters of surface and is likely to be amenable to shallow open pit mining with a low waste to ore ratio.

Alternative mining and stock piling methods has since been integrated into mining methods and therefore the applicant; are investigating the roll-over method of open cast mining. This mining method is currently viewed as having the least detrimental environmental impacts on the surrounding environment as rehabilitation is continuous with mining operations.

In terms of this project various mining methods alternatives were investigated and are discussed below.

1.7.3.1 Area Mining

The most used surface mining method for is strip or area mining (Refer to **Error! Reference source not found.**). Strip mining exposes the ore by removing the overburden (the earth above the seam(s)) in long cuts or strips. The spoil from the first strip is deposited in an area outside the planned mining area. Spoil from subsequent cuts is deposited as fill in the previous cut after Manganese and Iron has been removed. Usually, the process is to drill the strip of overburden next to the previously mined strip. The drill holes are filled with explosives and blasted. The overburden is then removed using large earthmoving equipment such as draglines, shovel and trucks, excavator and trucks, or bucket-wheels and conveyors. This overburden is put into the previously mined (and now empty) strip.

1.7.3.2 Contour Mining

The contour mining method consists of removing overburden from the seam in a pattern following the contours along a ridge or around a hillside (Refer to Figure 5: Contour mining in Brazil). This method is most commonly used in areas with rolling to steep terrain. It was once common to deposit the spoil on the down slope side of the bench thus created, but this method of spoil disposal consumed much additional land and created severe landslide and erosion problems.

To alleviate these problems, a variety of methods were devised to use freshly cut overburden to refill mined-out areas. These haul-back or lateral movement methods generally consist of an initial cut with the spoil deposited down slope or at some other site and spoil from the second cut refilling the first. A ridge of undisturbed natural material 6.1m wide is often intentionally left at the outer edge of the mined area. This barrier adds stability to the reclaimed slope by preventing spoil from slumping or sliding downhill.

The limitations on contour strip mining are both economic and technical. When the operation reaches a predetermined stripping ratio (tons of overburden/tons of ore), it is not profitable to continue. Depending on the equipment available, it may not be technically feasible to

Figure 5: Contour mining in Brazil

1.7.3.3 Underground Mining

Thus underground mining method was not considered a viable or appropriate mining option and therefore will not be investigated further

1.7.4. Mineral Processing Methods

The consideration of alternatives for mineral processing is restricted to proven technologies that have similar environmental consequences. As such the criteria for selecting alternatives is mainly operational and economic.

Options considered

Beneficiation of ores may be defined as the method of upgrading and enriching the useful mineral content of the ores, by removing undesirable and deleterious components.

The processes adopted depend on the physical and chemical characteristics of the ore minerals, to take advantage of properties like specific gravity, magnetism, surface characteristics etc. The beneficiation processes normally employed are: washing; gravity

concentration - jigging, heavy media separation, spiraling and tabling; and magnetic separation and floatation.

Options for producing standard grade ores:

- Crushing and screening of ROM
- Selective mining of ores
- Blending of ores to achieve a constant grade
- Options for producing beneficiated ore:
- Dense media separation of ores
- Jigging of ores.

1.7.5. Transport, Power and Water Supply Routes

Transport routes

The options for project related transportation include road transport and railway transport. The following transport routes are located in the project area:

- R325 between Postmasburg and Kathu
- Ngqura Manganese Ore Line. This line is the main carrier of manganese ore from the Kalahari Manganese Field (KMF) to the coast.

Emang Mmogo is considering four transport options:

- Railing product in bulk from the Emang Manganese Project to Port Elizabeth down the existing bulk rail line;
- Trucking product to Bloemfontein and then loading sea containers for railing to Port Elizabeth or Coega; and
- Railing product to Durban or Richards Bay Dry Bulk Terminal for export in bulk carriers.

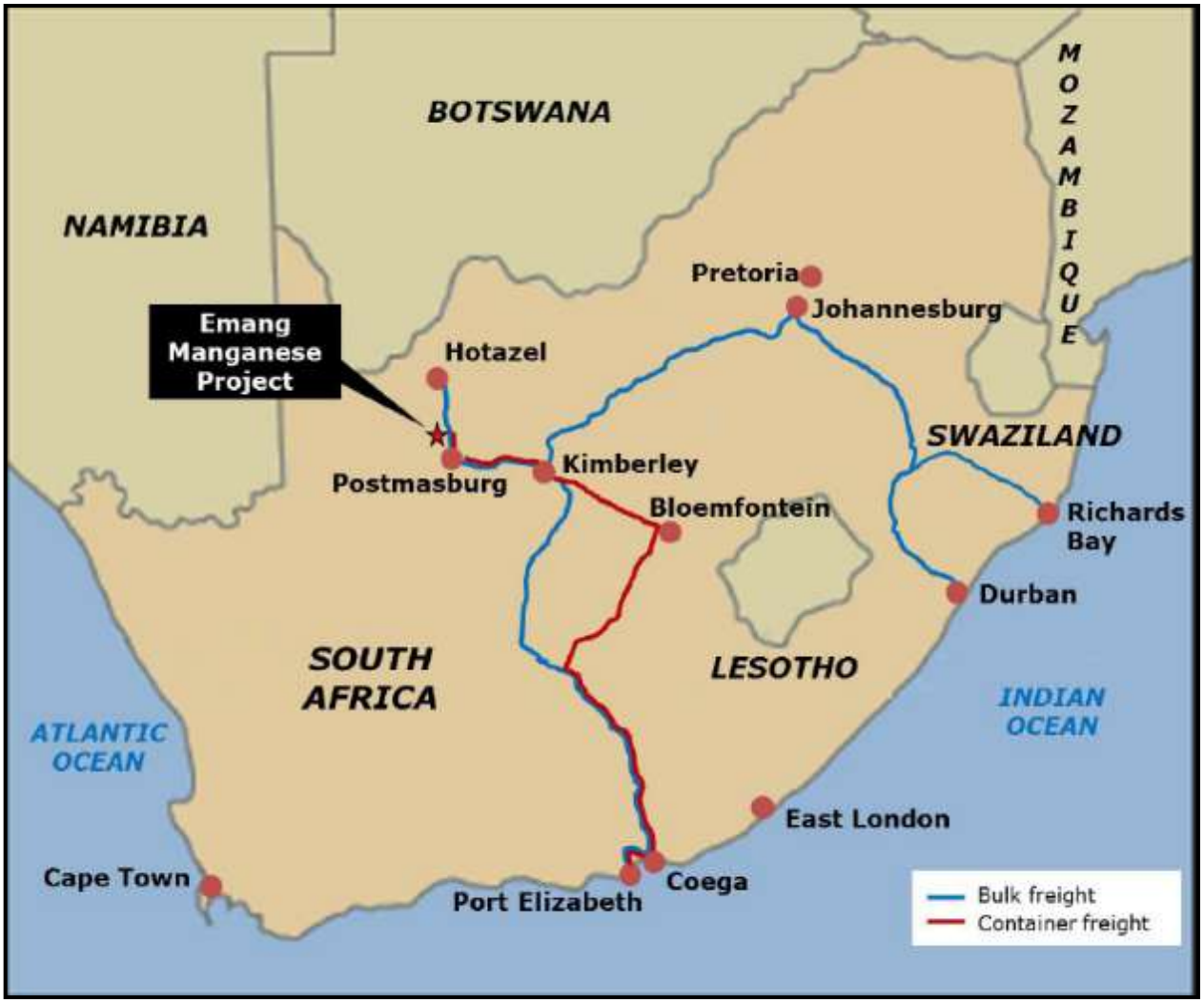

Figure6.Transport options for Emang Mmogo

Ore and waste haulage:

- Conveyor belts
- Haul trucks

As a result of their application flexibility, truck and shovel systems are always popular and widely applied in mining.

Power supply and routes

- The mine will be supplied with electricity by ESKOM through the national grid system and the mine's own transformer system. The envisaged supply is 11 KVA.
- Diesel powered generators may also be used as an option. In case of electrical failure, it is proposed that generators will be installed on site as back up.

Water supply and routes

Sources of water that could be used include

- Water from the Vaal-Gamagara pipeline
- Water from Boreholes

- Dewatering from the open-pit sections

1.7.6. Status Quo / No-Go Alternative

The “do nothing” alternative entails that the property retains its current status quo, which would mean that once the prospecting right expires no additional activity would occur. It must be noted that the project area was previously mined by Assmang and there was no rehabilitation process that took place after the mine was abandoned. This therefore means that there will still be open-pits and large volumes of waste dumps on site, which pose a threat to livestock that graze on site as well as humans.

Given the current state of the property with respect to the large areas that have been mined and not rehabilitated the economic feasibility of this area as a farming unit is questionable. The area is described as non-arable low potential grazing land. The grazing capacity is between 16 -29 ha per LSU.

1.8 SERVICES

1.8.1. Water

The proponent Emang Mmogo(Pty) Ltd proposed to apply for a Water Use License Application (WULA) as required by the National Water Act; 1998 (Act No 36 of 1998)

A Water Use License generally is required when a water use needs to be licensed. This is typical for larger and more complex developments where there may be abstraction of water, construction of dams, irrigation with sewerage effluent, bridge construction, etc. A Water Use License application may take between 6 months and 2 – 3 years, depending on the complexity of the application. Before a Water Use License is granted, the Department of Water Affairs and Forestry (DWAF) will need to determine the reserve. In certain catchments, a reserve may have been determined and in others it may not yet have been determined, which could delay the issuing of a Water Use License.

The following sources of water supply are available

Boreholes and water from the Gamagara pipeline, to the east of the property, used for drinking, production and domestic water purposes

Fissure water and storm water which will collect in the Open cast mine will be pumped out and used for dust suppression and as process water.

1.8.2. Electricity

The mine will be supplied with electricity by ESKOM through the national grid system and the mine's own transformer system. The envisaged supply is 11 KVA.
Diesel powered generators may also be used as an option. In case of electrical failure, it is proposed that generators will be installed on site as back up

1.8.3. Waste

The general waste associated with the offices and plant area will be temporarily stored in bulk waste bins; which will be cleared by a waste removal company e.g. Wasteman or Interwaste.
Slimes Dams:
Slimes produced during the first three years of crushing and screening operations will be pumped to the slimes dams which will be located as shown on the mine infrastructure layout plan refer to Figure 3.

1.8.4. Housing

No employees will be allowed to stay on the property.
Housing will be provided by means of:
Implementing the policy to employ the workforce, as far as possible, from the surrounding communities.

1.8.5. Storage of Diesel

The above ground storage of diesel on site will take place so as to have an adequate provision of fuel for the backup generators and other machinery and vehicles on site. The necessary safety precautions and fire protection measures will be installed.

1.8.6. Storage of Explosives

An Explosives off-loading, storage and distribution area will be located on site.

The main requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) regulations are as follows:

- Anyone manufacturing or storing explosives must take appropriate measures to prevent fire or explosion; to limit the extent of any fire or explosion should one occur; and protect persons in the event of a fire or explosion. These are the key requirements of the regulations and are backed up by extensive guidance in the Approved Code of Practice;
- In most cases a separation distance must be maintained between the explosives building and neighbouring inhabited buildings. This is intended to ensure that risks to those living or working in the area are kept to an acceptable level;
- With certain exceptions a licence is required for the manufacture or storage of explosives. Health and Safety Executive (HSE) licenses manufacturing activities because of the greater risks involved. HSE also licenses larger explosives storage facilities. In most cases, stores holding less than two tonnes of explosives are either licensed or registered by the local authority or the police;

2. DESCRIPTION OF THE ENVIRONMENT

2.1 BIOPHYSICAL ENVIRONMENT

It is important to note that the proposed mining activity is surrounded by areas which are associated with extensive mining activities. These activities have a large influence on the natural *status quo* of the area. Historically, planning of developments did not include the natural environment and consequently led to the wasteful exploitation and the destruction of sensitive habitats. Legislation now requires that a Scoping EIA process be undertaken prior to the approval of a development. This ensures that developments are planned in a manner that makes the best possible use of natural resources and limits environmental degradation.

This chapter provides a description of the key characteristics of the biophysical and socioeconomic environment within which the proposed project is located. The description of the affected environment is based on relevant information presented in the scientific literature. Understanding of the affected environment was enhanced by a field trip conducted to the study area.

The Emang Mmogo project is located in the Northern Cape Province of South Africa, approximately 30km north of Postmasburg. The property is readily accessible from the R325, which is a tarred, provincial road leading from Kathu to Postmasburg. A gravel road provides access from the R325 to the village of Glosam. The village of Lohatla is located north east of the site.

The railway line from Sishen to Postmasburg is situated directly east of the properties. The Ertsrand railway siding is approximately 2.2km southeast of the project area. The Gamagara water pipeline passes the study site west of the R325.

2.1.1. Geology and Geotechnical Suitability

The Emang Project is located within the Maremane Dome in the Northern Cape Province The Manganese deposits belong to the bixbyite rich Western Manganese Belt of the Postmasburg Manganese Field. (Tenure Minerals Consultants, 2012) The manganese deposits of the

Postmasburg area are related to the unconformity between the Campellrand Subgroup of the Ghaap Group and the Gamagara Formation of the Maremane dome. It has also been commented that the Campbellrand dolomite sequence and the Manganore Iron Formation of the Gjhaap group outcrop on the dome.

This is unconformably overlain by conglomerate or shale of the Gamagara formation. Supergene bixbyite rich manganese deposits are developed in the Sishen shale member of the Gamagara formation where the Gamagara formation rests on the manganiferrous dolomite of the Reivilo Formation of the Campbellrand Subgroup.

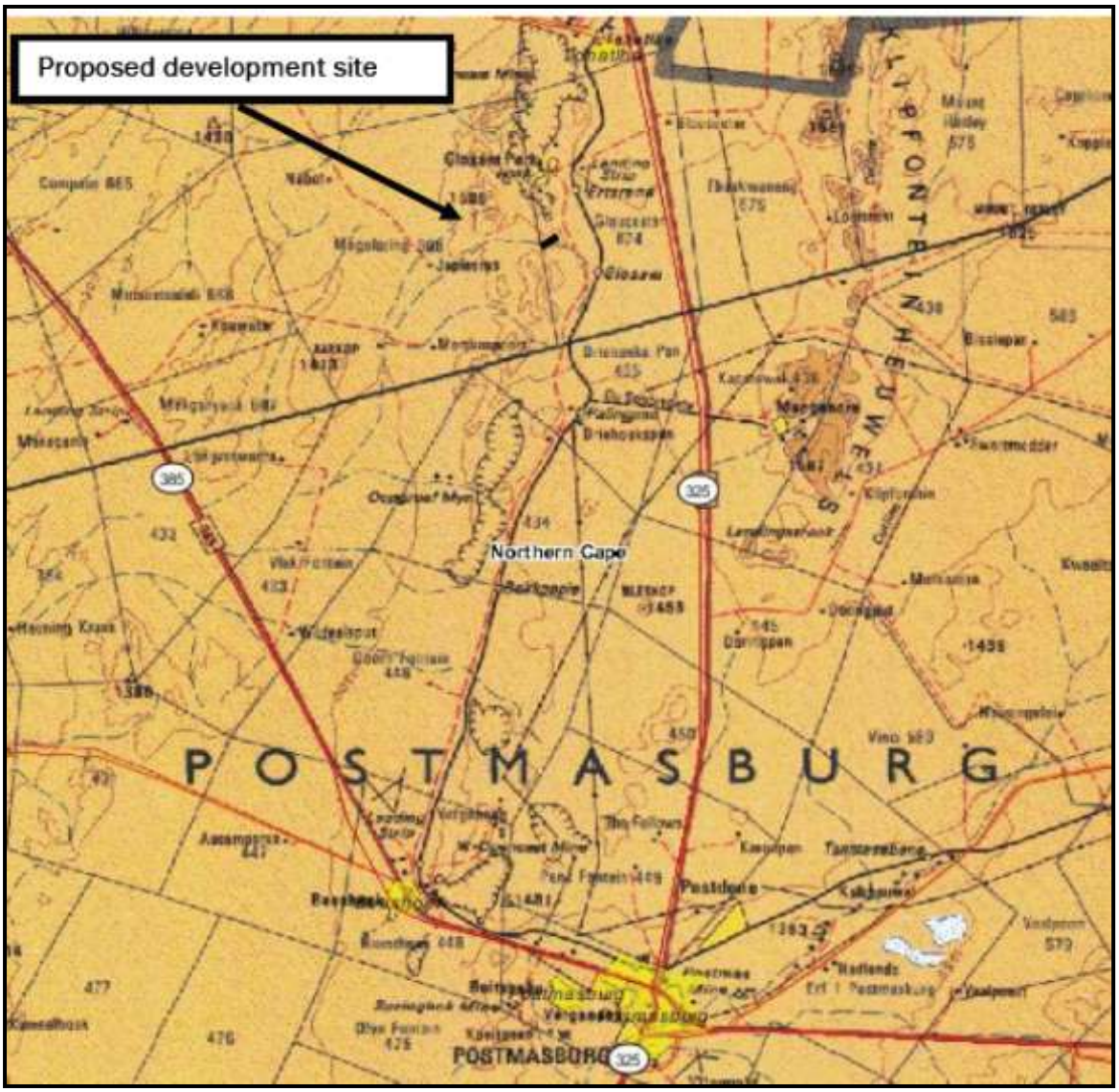

Figure 7: Locality map of the proposed mining development in relation to Postmasburg.

The slumping of the manganese deposits took place in the sinkholes that formed in the Campbellrand Subgroup dolomites during a period of erosion, before the deposition of the Gamagara Formation. In the central part of the Maremane dome the palaeosinkholes were filled

with alumina-rich shale and manganese wad. Thrust faulting in the region has caused that the Ongeluk lava of the Transvaal Supergroup is now overlying the Gamagara Formation. (Tenure Minerals Consultants, 2012).

The manganese deposit at the Emang Mmogo Manganese Project is irregular in shape due to the formation conditions, where the manganese deposit slumped into paleo-sinkholes. This caused topography of dolomite pinnacles with pockets of manganese deposits. The most common manganese mineral present is bixbyite, which also occurs in the recrystallized wad.

Paleo sinkhole development and supergene enrichment took place during an erosion period that preceded the emplacement of the Gamagara Formation. It would seem that the Manganore Iron-formation slumped into sinkholes. Brecciation and recrystallization took place (Tenure Minerals Consultants, 2012).

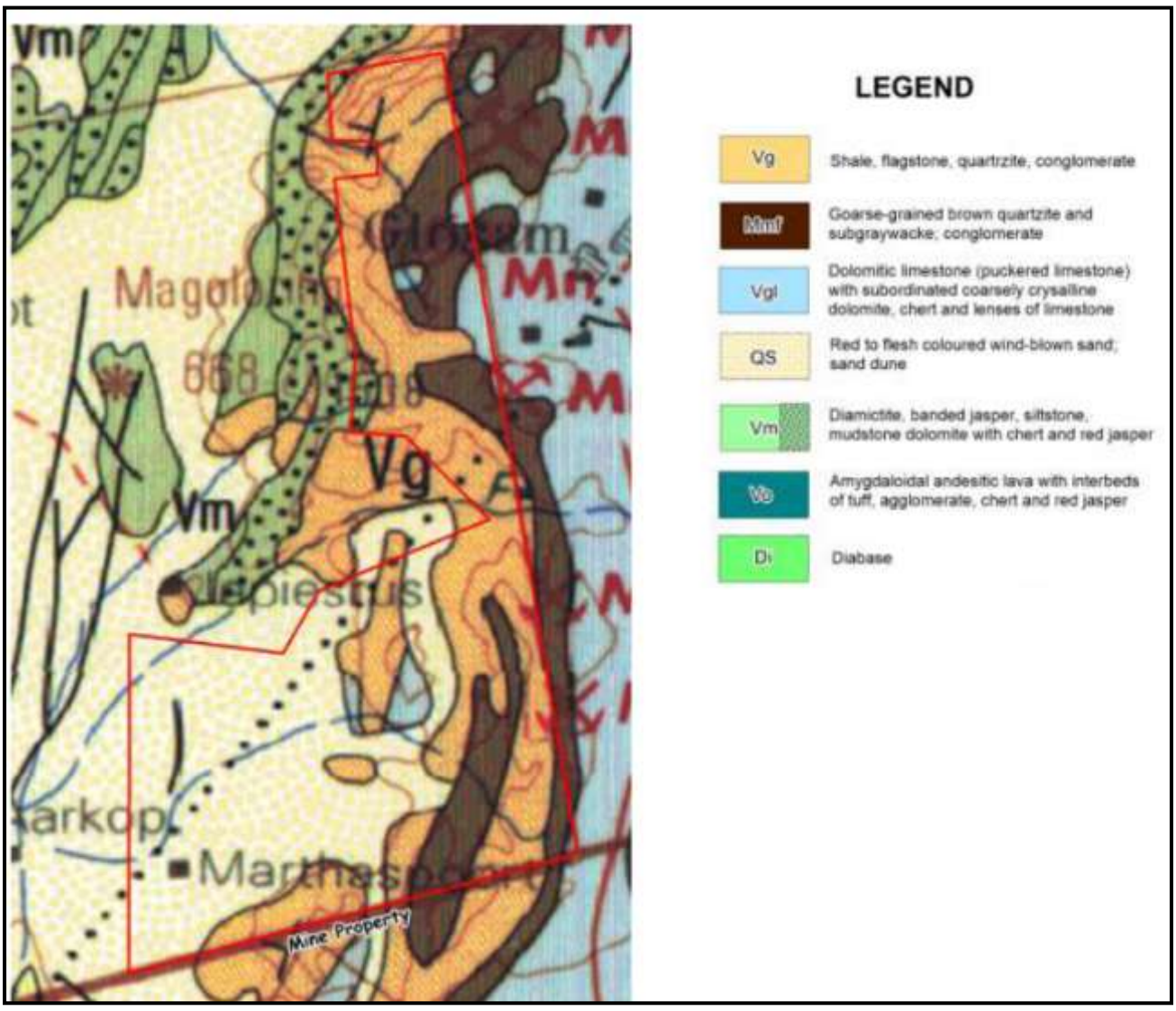

Figure 8: Geological map of the study area and immediate surrounds

2.1.2. Soils and Agricultural potential

The project area is characterised by red wind-blown (0.3-1.2 m deep) sand (See Picture 1 below) and Hutton soil form mixed with manganese and iron ore rock deposits. The red wind-blown soil is mixed with the Hematite iron ore mineral deposits. Erosion is low due to the insufficient MAP and runoff volumes within the D41J catchment.

Figure 9: Example of the soil profile within the proposed mining area

The area is described as non-arable low potential grazing land. The grazing capacity is between 16 -29 ha per LSU. Owing to the open pits and waste dumps currently on site the area is considered mostly unsuitable for stock farming

2.1.3. Hydrology

The study area lies within Lower Vaal Water Management Area. Two sub-catchment have been identified for the study area to determine the drainage of water across the area:

a) The Northern sub catchment and

b) Southern sub catchment.

The northern sub-catchment (indicated in green in Figure 5.8.1) lies within the Drainage region D41J. The surface water drainage originates from the eastern and western boundaries of the proposed mining area. The flow follows the topographic low to the non-perennial stream in the center of the study site and then flows north into the Dam (identified as BP01 in Figure 5.8.1, which is located outside the mining area). Water from this dam continues along the non-perennial stream towards the adjacent farms. The southern sub catchment (indicated in blue in Figure 5.8.1) lies within the Drainage region D73J. The surface water drainage from the eastern boundary across the study area in a westerly direction. Water follows the topographic low from the eastern boundary to the west from where it follows the non-perennial stream located to the south west of the mining area. Surface water impoundments within the area have been identified as BP01 and BP02 in in the non-perennial water courses during periods of high rainfall.

Figure 10: The dams BP01 and BP02 both of these are constructed sand dams that hold water when water flows

2.1.4. Groundwater

Ggroundwater in this area occurs in both secondary (or fractured rock) aquifers and primary aquifers. The first is formed by jointing and fracturing of the otherwise solid bedrock. These fractures are formed by faulting, cooling of magma outflows, intrusion of dolerite dykes, folding and other geological forces. Generally the harder rocks (quartzite, jasper and lava) fracture more easily under stress to form superior aquifers compared to the softer sediments like shale which rather deform than fracture under stress.

Dolomite of the Ghaap Group has generally good groundwater potential and yields in excess of 2 l/s are common. Groundwater can be develop from the fractures joints and solution cavities

commonly associated with faults and diabase dykes as well as from fractured sub ordinates carbonaceous shales beds. Faults and dykes can often easily be targeted due to the occurrence of calcrete mounds and trees along the structures. Solid structure less dolomite however should be avoided when siting boreholes.

There are a number of boreholes situated within and around the study area. Of these7 % are for both domestic and livestock purposes, 4% are used solely for domestic purposes, 27% for livestock purposes and 1% for irrigation. Most of the borehole that have been drilled within and around the study area, have been drilled for exploration purposes.

The groundwater table depth in the area ranges between 13.66 and 60.5 mbgl. The water levels measured within the study area ranges between 13.66 and 60.5 mbgl.

In general water quality in the area is within the standards for domestic use, there are some areas that have a high manganese concentrations. This can be associated with natural occurrence of manganese in this area. The levels of N03-N concentration in some areas are also high which could be related to livestock farming activities.

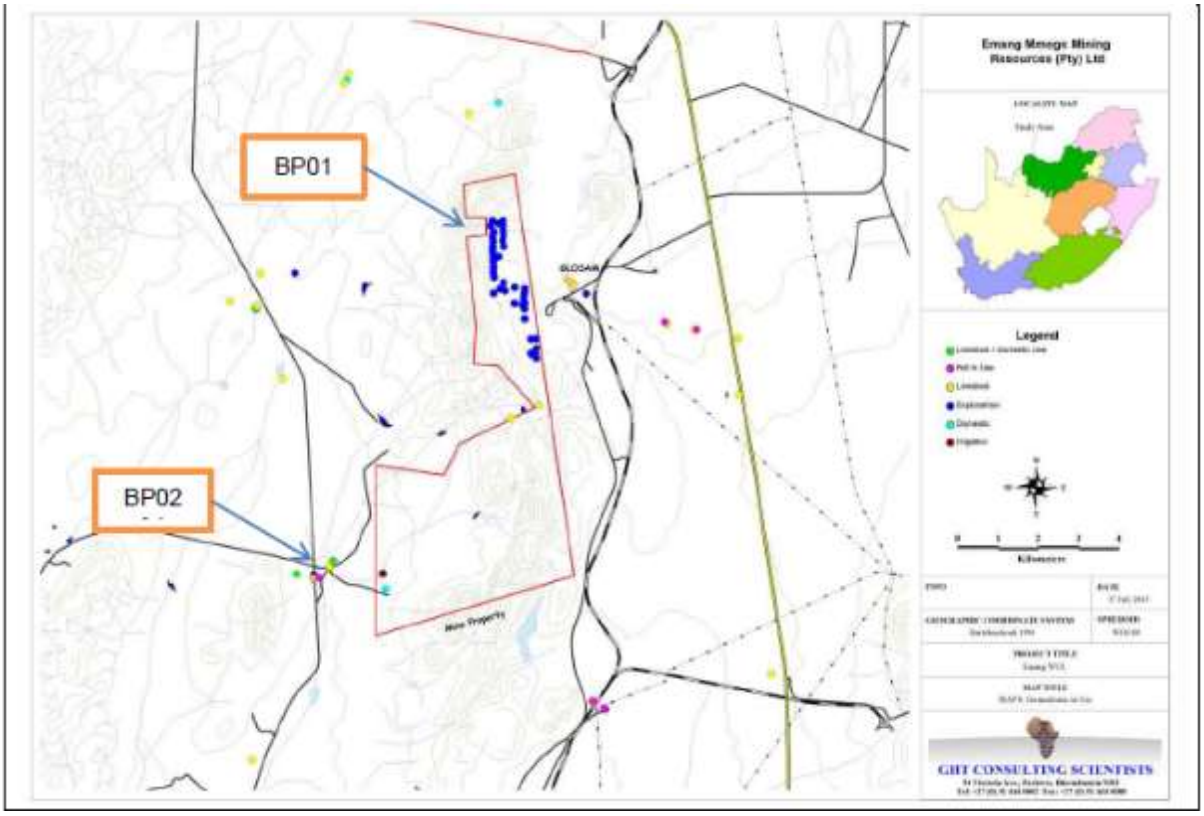

Figure 11: Location of boreholes with and around the study area

2.1.6. Climate

The proposed mining operational area comprises of summer and autumn rainfall with very dry winters. The actual Mean Annual Precipitation (MAP) is about 358 mm. However, the maximum MAP can reach about 450 mm. The wet season occurs between the months of October to March. In addition, the mean monthly maximum and minimum temperatures is about 35.9°C and -3.3°C for January and June respectively. Frost is frequent usually occurs in winter seasons. The Mean Annual Evaporation (MAE) is in the range between 2200-2600 mm (Bassom and Rossouw, 2003).

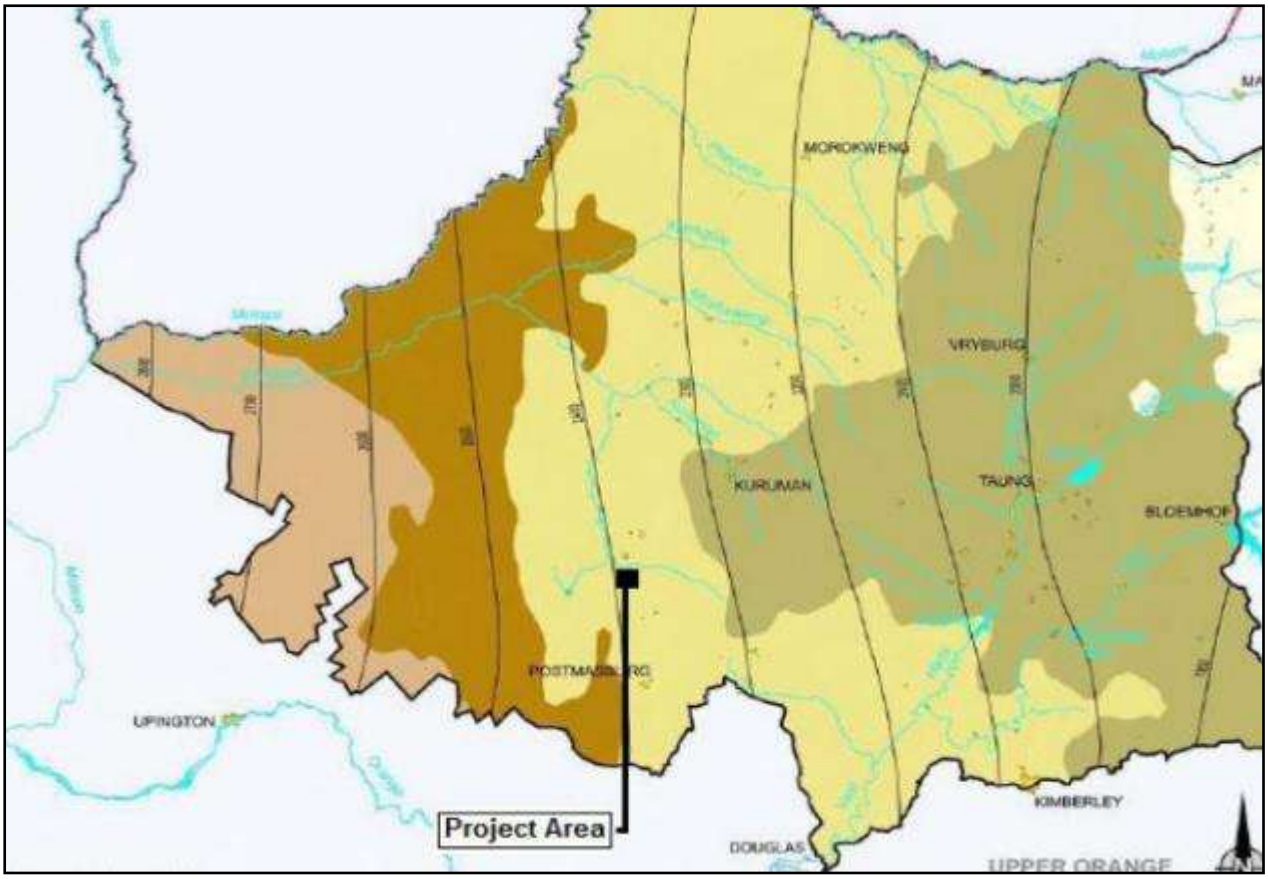

Figure 12: Climate of the study area (Bassom and Rossouw, 2003)

2.1.6.1 Temperature and Rainfall

The climate of the area is typical of a semi-desert with very hot summers and cold winters. Temperature data for Postmasburg (as supplied by the South African Weather Service) for the period 1998-2011 is summarized in Table 1.

January is the hottest month with an average maximum daily temperature of 32.7°C and July the coldest with an average maximum daily temperature of 19.5°C. During June and July the average minimum daily temperature drops to <3°C. The maximum temperature recorded during this period was 39.8 0C and the lowest 6.9°C.

The study area falls within the summer rainfall area with a mean annual precipitation (MAP) of 385.3 mm for the study area. The average monthly precipitation and standard deviation (SD) values for Lomoteng Mine just to the north of the proposed mine, are summarized in Table 2 below, which indicates that ~84% of the mean annual precipitation occurs during the months November to April. This phenomenon is characteristic of a summer rainfall area. March is the wettest month with an average precipitation of ~75 mm whilst July is the driest with <4 mm.

Table 5: Temperature data for Postmasburg (South African Weather Services)

Month	Ave Temp (°C)	Max Temp (°C)	Min Temp (°C)	Ave Rain (mm)
Jan	23.7	32.7	16.1	40.8
Feb	22.8	31.7	16.1	79.1
Mar	21.3	30.3	14.6	29.3
Apr	17.0	26.4	11.0	22.0
May	11.9	22.2	5.5	9.3
Jun	8.9	20.0	2.3	5.2
Jul	8.4	19.5	1.3	1.1
Aug	11.3	22.3	3.5	3.2
Sep	15.7	26.5	7.0	7.8
Oct	19.7	29.7	10.9	17.9
Nov	21.7	31.4	12.9	15.0
Dec	23.8	33.3	15.5	23.6
Mean Annual Precipitation (mm)				254.3
Absolute min temp recorded (26/07/2004)				-6,9°
Absolute max temp recorded (22/12/2009_				39.8°

Table 6: Average Monthly Precipitation measures at the nearest weather station -Lomoteng

Average Monthly Precipitation for Lomoteng (Station Coordinates: S28°01' E23°01')		
	Mean (mm)	SD (mm)
Jan	62.1	43.6
Feb	71.5	47.5
Mar	74.9	47.8
Apr	41.9	34.3
May	16.4	19.3
Jun	5.4	110
Jul	3.9	8.8
Aug	5.5	10.6
Sep	10.6	15.2
Oct	20.1	21.1
Nov	29.7	26.1
Dec	43.1	33.9
Annual	385.3	104.6

2.1.6.2 Topography

The topography is mountainous with a gentle slope down towards the west, varying between approximately 1465 mamsl at the eastern boundary and 1507 mamsl at the western, with a non-

perennial stream at approx. 1408 mamsl between the two topographic highs. The terrain is described as high open hills and ridges with an average slope angle of between 6 – 8%.

The topography of the study area has already been disturbed by previous mining activities. The study area was mined by Assmang Ltd in the 1960 to 1980's. Assmang did not undertake any rehabilitation on the site after they seized their operations, thus there are pits and large stockpiles all over the study area.

Figure 13: The topography of the proposed development site on the western side.

2.1.7 Fauna and Flora

Vegetation Description

The study area falls with three vegetation types, Kuruman Mountain Bushveld, Kuruman Thornveld and Olifantshoek Plains Thornveld (Mucina & Rutherford 2006). The Kuruman Mountain bushveld is described as occurring on rolling hills with gentle to moderate slopes and hill pediments with an open shrubveld. The grass layer is generally well developed and the shrub layer is dominated by *Lebekia macrantha*. Other important taxa include, *Rhus lancea, Euclea crispa, Rhus ciliata, Gomphocarpus fruticosus*, *Anthephora pubescens, Digitaria eriantha, Eustachys paspaloides, Geigeria ornativa,* and *Helichrysum cerastiodes*.

The Kuruman Thornveld is typically found on flat rocky plains and some sloping hills. It has a very well developed closed shrub layer and well developed open tree stratum. Important taxa within this vegetation type includes, *Acacia erioloba, Acacia mellifera, Lycium hirsutum, Tarchonanthus*

camphoratus , Acacia hebeclada, Aristida meridionalis, Eragrostis lehmanniana, Dicoma schinzii, Limeum fenestratum and *Nolletia ciliaris*.

The Olifantshoek Plains Thornveld is found on plains with an open tree and shrub layer, formed by species such as *Acacia luederitzii, Bosica albitrunca* and *Rhus tenuinervis*. The grass layer is usually sparse with species such as *Schmidtia pappophoroides, Stipagrostis uniplumis* and *Aristida congesta*.

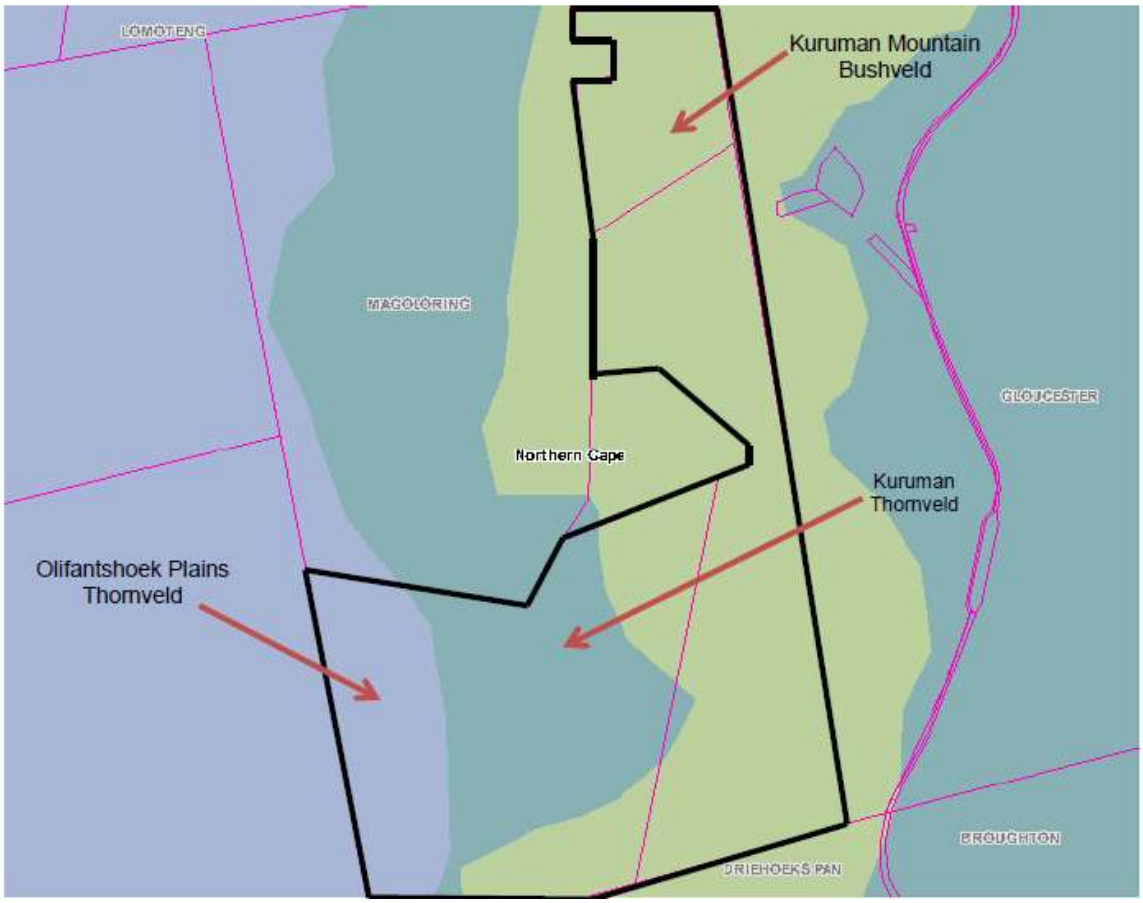

Figure 14: The vegetation map of the study area according to Mucina & Rutherford (2006).

The area has been subjected to previous mining activity that was not rehabilitated and consequently waste dumps and open pits cover much of the study area. Most of the disturbed areas have been re-colonised by vegetation. Although bare patched of exposed substrate are evident, there are many small trees and shrubs through the area. The vegetation within the disturbed areas is however considered secondary in nature

Floral species of Conservation Concern

Historical records of Red List plant species were consulted in order to determine the likelihood of any such species occurring in the study area. Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African

National Biodiversity Institute. *Hereroa wilmaniae* L.Bolus a perennial succulent has been recorded within the quarter degree square 2823AA in which the study area falls, this species is listed as data deficient (DDT). There have been no other species recorded on site or in the quarter degree grid that appear on the IUCN-Red Data List. Protected tree species that may occur on the property could include, *Acacia erioloba,* and *Boscia albitrunca.*

Faunal species of Conservation Concern

Protected faunal species found in habitat typical of the study area and surrounding areas that could have the potential for occurrence on site would include:

The Kori Bustard, Lappet-faced Vulture, White-backed Vulture, Martial Eagle, Tawny Eagle and Secretary Bird are Red Listed Birds, which may occur in the area.

2.2 SOCIAL ENVIRONMENT

2.2.1. Visual Resources

Project-related activities have the potential to alter the landscape character of the site and surrounding area through the establishment of both temporary and permanent infrastructure. As a baseline, this section provides an understanding of the pre-mining visual character of the project area against which to measure potential change as a result of project infrastructure and activities.

The project area lies in an undulating Mountainous terrain. The area has been subjected to previous mining activity that was not rehabilitated and consequently waste dumps and open pit abound the study area. Most of the study area has been re-colonised by vegetation so although bare patched of exposed substrate are evident, there are many small trees and shrubs through the area.

Central to the visual character of an area are the concepts of sense of place and scenic quality. Sense of place is informed by the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area which lend that area its uniqueness and distinctiveness. The scenic quality of the project site and surrounding area is linked to the type of landscapes that occur within an area. In this regard scenic quality can range from high to low as follows:

- High – these include the natural features such as mountains and koppies and drainage systems.
- Moderate – these include agricultural activities, smallholdings, and recreational areas.
- Low – these include towns, communities, roads, railway line, industries and existing mines.

Numerous mining related activities exist in the area to the south and north of the project area. The undulating nature of the terrain within the proposed mining area however limits the extent of visual intrusions. The area has already been disturbed by previous mining activity the result is a landscape with a fairly poor sense of place and a moderate to low scenic quality.

2.2.2. Noise and Vibration

Exisitng noise sources on site, and the immediate surrounds include:

- Railway transport and associated shunting noise;
- Heavy vehicle movement of mine vehicles in proximity to the study area;

- Agricultural activities on surrounding land;
- Mining and mineral processing activities at the mining areas to the south east and north east of the site; and
- Vehicles and trains serving the exisitng mines and farming communities.

2.2.3. Air Quality

Identification of existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts, which in turn, may cause a disturbance to nearby receptors. Ambient air pollutant concentrations within the Postmasburg region occur not only due to local sources but also as a result of emissions from various remote sources. The most significant of these sources located within the region include:

- fugitive dust emissions from mining, tailings impoundments and mineral processing operations, which are associated with manganese and iron mining operations;
- vehicle tailpipe emissions-significant primary pollutants emitted by motor vehicles include CO2, CO, hydrocarbons (HCs), NOx, SO2, particulate matter and lead;
- vehicle entrained dust from paved and unpaved roads;
- household fuel combustion by means of Manganese and Iron and wood;
- biomass and veld burning; and
- Various miscellaneous fugitive dust sources, including: agricultural activities and wind erosion of open areas.

Air quality monitoring and modelling should for future activities concentrate on dust fallout and ambient PM10 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.

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

- The handling of ore, at these mines;
- Ore processing operations;

- Stockpiled materials and the mines and at the Manganese and Iron loading siding;
- Disturbed land or land denuded of any vegetation;
- Vehicle movements on un-surfaced roads; and
- Disposal facilities.

2.2.4. Heritage Resources

In terms of section 38 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), a Phase 1 Archaeological Impact Assessment was undertaken by David Morris from the McGregor Museum for the property prior to the commencement of prospecting activity, in 2008. A summary of this report is given below. The study was undertaken in order to establish if any localities of heritage significance were present on the property. None of the observed sites proved in themselves to be of major significance, but collectively they provide insight into the Stone Age occupation of the area.

No post-Stone Age/colonial era heritage traces were noted in the area examined and the farmer Mr Arrie Claasens, who grew up on the farm, knew of no such sites or features within the Portions 4 and 5 of Magoloring. No heritage traces of the nineteenth-twentieth century were noted. The farmer, Mr Claasens, who has known the farm for more than half a century (he indicated that he had grown up there and as a boy hunted baboons in the hills), said that he knew of no graves of any nature in the valley

2.2.5. Socio-economic

The study area falls within the Tsantsabane Municipality in the Siyanda District in the Northern Cape. The Northern Cape has five municipal districts, namely Frances Baard, Siyanda, Namaqua, Kgalagati and Pixely Ke Seme. Siyanda District Municipality (SDM) forms the mid-northern section of the province on the frontier with Botswana. It covers an area of more than 100,000 square kilometers (almost 30% of the entire Province) out of which 65, 000 square kilometers compromise the vast Kalahari Desert, Kgalagadi Transfrontier Park and the former Bushman Land. Siyanda District comprises six Local Municipalities namely: Mire; Kai! Garb; Kara Hais;

Tsantsabane! Kheis and Kgatelopele. Upington is the district municipal capital where the municipal government is located. The whole area is managed by the Siyanda District Municipality, which is classified as a category C Municipality. The Census report of 2001 showed a population of 202 160 and 238 063 in the 2007 Community Survey. (Census, 2001; Community Survey, 2007)

The above table recorded an increase of 35 903 people that represents a 17, 8% increase in overall population when comparing the 2001 Census and 2007 Community Survey. Note the DMA has since been incorporated into the neighboring municipalities. The aforementioned table shows that the majority of the population is located in the //Khara Hais Municipality (42%), followed by the Kai! Garib Municipality (24%) and the Tsantsabane Municipality (12%). The Main settlements in the aforementioned municipalities are: Upington, Keimoes; and Postmasburg, respectively.

There are five hospitals in the SDM. There are only two Community Health Facilities in the SDM. There are 52 clinics in the SDM the clinics are generally located in settlements along the main routes through the municipality, namely the N14 and the N10. It should be noted that medical staff are not stationed at all these facilities on a full time basis and in some cases the staff are on site only once a month. (IDP, 2007-2011)

Tuberculosis and HIV/AIDS are some of the infectious diseases that are receiving priority attention and that a shortage of staff hampers the delivery of health services in the SDM. In this region the greatest social problems are considered to be illiteracy and poverty. According to the last socio-economic survey in 2000, approximately 60% of the inhabitants have a monthly household income of between R0 – R800. Poor health is often associated with factors such as malnutrition especially among the children. The malnutrition is often attributed to insufficient funds to acquire adequate food.

Malnutrition of children can also be attributed to the lack of education of parents who provide for the children. Adult literacy in the area is considered to be below standard. Siyanda District Municipality accounts for about 30% of the Northern Cape economy. Siyanda's economy is largely dominated by mining and agriculture the proposed mining development falls within the Tsantsabane local municipality. The extent of the geographical area of the municipality is 5 887km2. The major routes running through Postmasburg include the R385 from Kimberley that runs through Beeshoek, the R309 and the R325 to Kathu. Tsantsabane Municipality is characterized by a mixture of land uses of which agriculture and mining is dominant land use within the rural areas. The residential areas vary from the relatively large town of Postmasburg to small scattered rural communities. Some of these communities are the remains of railway stations.

According to Statistics SA Census Data (2001) 47.6% of the population of Tsantsabane Municipality is male and 52.3% is female. Approximately 31% of the population is under 14 years and ±33% is between 15 and 34 years. The statistics show that approximately 17% of the population is illiterate. The median qualification is, between Grade 7 and Grade 9, which means that a large part of the population can perform unskilled or semi-unskilled work. Less than 15% of

the population has a tertiary qualification or have completed Grade 12. According to Statistics SA Census Data (2001) 41% of the total labor force in the area is unemployed. This statistic indicates that there is a low level of skills development and hence the serious need which exists for adult education and in-service training programmes.

The most important employer in the Municipal Area is the mining sector

3. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS

3.1 APPROACH TO THE EIA

An Environmental Impact Assessment (EIA) is an assessment tool at a project level and is defined as the process of identifying, predicting, evaluating and mitigating the biophysical, social and economic impacts of development proposals prior to major decisions being taken. It identifies the environmental impacts of a proposed project and assists in ensuring that a project will be environmentally acceptable and integrated into the surrounding environment in a sustainable way.

The EIA for this project is undertaken in terms of the National Environmental Management Act (1998). The guiding principles of an EIA are listed below.

3.2 GUIDING PRINCIPLES FOR AN EIA

There are eight guiding principles that govern the entire process of EIA and they are as follows:

- **Participation**: An appropriate and timely access to the process for all interested parties.
- **Transparency**: All assessment decisions and their basis should be open and accessible.
- **Certainty**: The process and timing of the assessment should be agreed in advanced and followed by all participants.
- **Accountability**: The decision-makers are responsible to all parties for their action and decisions under the assessment process.
- **Credibility**: Assessment is undertaken with professionalism and objectivity.
- **Cost-effectiveness**: The assessment process and its outcomes will ensure environmental protection at the least cost to the society.
- **Flexibility**: The assessment process should be able to adapt to deal efficiently with any proposal and decision making situation.
- **Practicality**: The information and outputs provided by the assessment process are readily usable in decision making and planning.

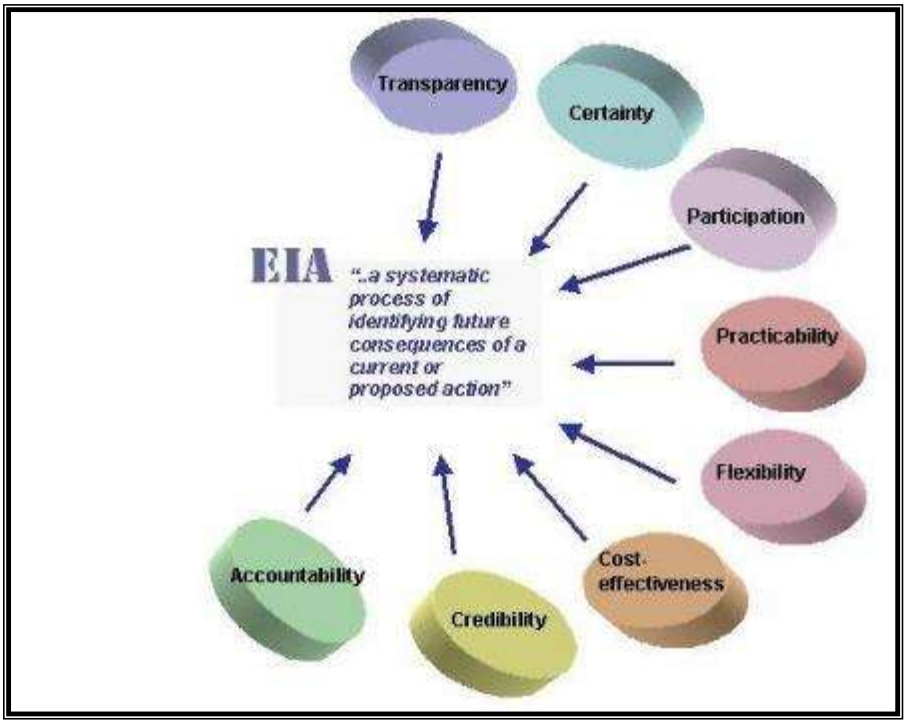

Figure 15: The eight guiding principles for the EIA process

A Scoping EIA process is considered as a project management tool for collecting and analysing information on the environmental effects of a project. As such, it is used to:

- identify potential environmental impacts,
- examine the significance of environmental implications,
- assess whether impacts can be mitigated;
- recommend preventive and corrective mitigating measures,
- inform decision makers and concerned parties about the environmental implications; and
- advise whether development should go ahead.

The EIA must take an open participatory approach throughout. This means that there should be no hidden agendas, no restrictions on the information collected during the process and an open-door policy by the proponent.

Technical information must be communicated to stakeholders in a way that is understood by them and that enables them to meaningfully comment on the project.

There should be ongoing consultation with interested and affected parties representing all walks of life. Sufficient time for comment must be allowed. The opportunity for comment should be announced on an on-going basis.

There should be opportunities for input by specialists and members of the public. Their contributions and issues should be considered when technical specialist studies are conducted and when decisions are made.

An EIA typically has four phases, as illustrated in the table below.

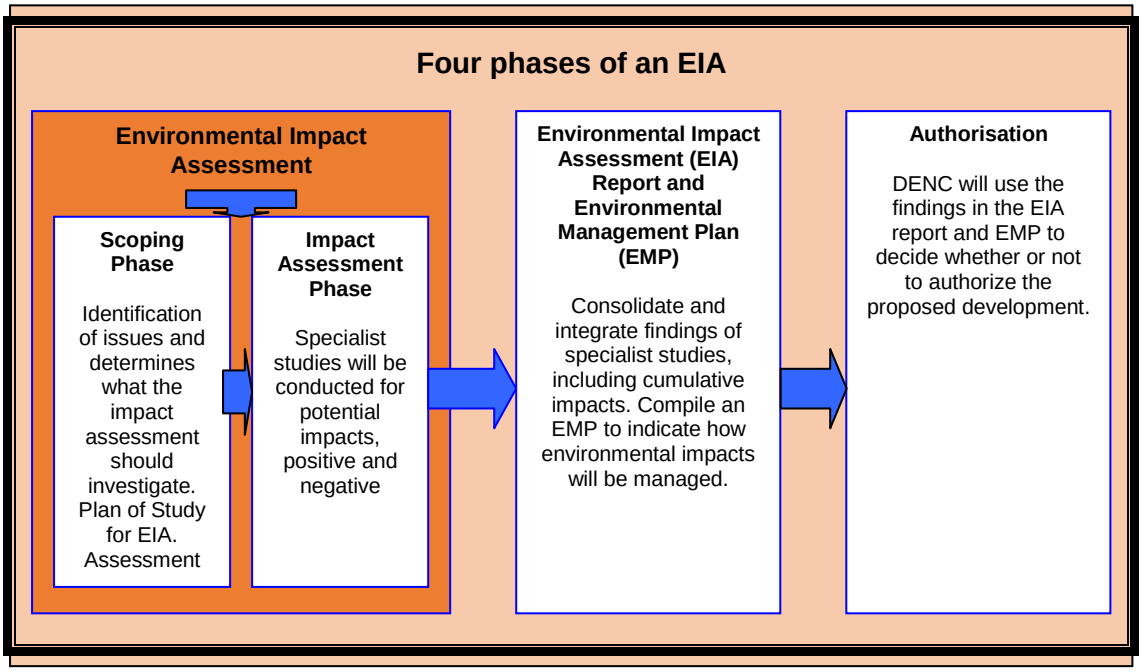

Figure 16: EIA Processes

3.3 SCOPING TECHNICAL PROCESS

This section provides a summary of the technical process followed for this Scoping EIA. The Scoping phase of the process was structured in such a manner as to ensure that it gives clear guidance to the requirements of the EIA phase of the process. Simply, the Scoping phase sets out the terms of reference for the EIA, identifying all environmental issues, which require further investigation. Scoping has the following objectives:

- To effectively identify and notify all Interested and Affected Parties (I&APs) of the project;

- Ensure that all concerns and issues of the I&APs are taken into account during the Environmental Impact Assessment phase of the project;
- To provide sufficient information to all I&APs that they can effectively participate in the EIA process;
- Focus the EIA on specific issues; which are important for the decision makers, thereby reducing the potential for any delays as a result of requests for additional information; and
- Develop the necessary terms of reference for all specialist studies to be undertaken as part of the EIA.

This Scoping report was prepared on the strengths of the information available to the team at the time of the assessment, in accordance with the principles of Integrated Environmental Management (IEM). Care has been taken to provide an objective document, to inform rational decision making.

3.3.1. Information gathering

Early in the EIA process, the technical specialists identified the information that would be required for the impact assessment and the relevant data was obtained. In addition, the specialists sourced available information about the receiving environment from reliable sources, interested and affected parties, previously documented studies and EIA Reports in the area. The EIA team then visited the site to gain first-hand information and an understanding of the existing conditions of the proposed mining property, and to identify any alternatives that may be relevant.

3.3 EIA REPORT

The Environmental Impact Assessment Report (EIA Report) expands on the key issues and concerns identified during the Scoping phase and incorporates the authority's comments on the Scoping Report. Specialist investigations were conducted and inform decision making during the EIA phase of the project. The specialist studies assisted with the assessment of anticipated impacts as identified in the Scoping phase and highlighted the key areas of concern as well as necessary mitigation measures. Mitigation measures were provided for each impact. Where

applicable, various alternatives were evaluated. The Environmental Assessment Practitioner (EAP) assessed the impacts using professional judgement and scientific evaluations, where possible.

3.4 SPECIALIST STUDIES

The following specialist studies were identified and undertaken:

(a) Soil and Land Capability Report

(b) Air Quality Report

(c) Social Impact Assessment Report

(d) Traffic Assessment Report

(e) Hydro census Report

(f) Heritage Report

The specialists employed the following basic methodology:

- Site visits;
- Sampling where necessary;
- Desktop studies;
- Assessment of baseline data;
- Assessment of impacts;
- Development of appropriate mitigation measures; and
- Documenting the findings in the form of reports.

The results of the specialists' studies were analysed and interpreted in order to assess the potential impacts, which the proposed development may inflict on bio-physical and social systems, devise potential alternatives, and the development of necessary mitigation measures in order to minimise negative impacts and optimise positive impacts.

The specialists' recommendations were also incorporated into the Environmental Management Programme (EMP). The activities which were described in the project description were assessed in terms of direct, indirect as well as cumulative impacts, where possible.

<u>Specialist Impact Identification and Assessment:</u>

The specialists specifically differentiated between the environmental impacts associated with the construction and maintenance of the proposed mine. As far as possible, the specialists were

required to quantify the suite of potential environmental impacts identified in their studies and assess the significance of the impacts. Each impact was assessed and rated. For the purposes of the Environmental process, the term 'assessment' refers to "*the process of collecting, organising, analysing, interpreting and communicating data relevant to some decisions*" (Stauth et al, 1993).

The assessment of the data was, where possible, based on accepted scientific techniques, failing which, the specialists made judgements based on their professional expertise and experience.

Assessment Criteria:

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 NEMA.

The level of detail as depicted in the EIA regulations was 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 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 Assessment Criteria utilised during the EIA phase of the project will be described in more detail in Section 4: Assessment Methodology.

3.5 PUBLIC PARTICIPATION PROCESS

The principles of NEMA govern many aspects of EIAs, including consultation with interested and affected parties (I&APs). These principles include the provision of sufficient and transparent information to I&APs on an ongoing basis, to allow them to comment, and ensuring the participation of historically disadvantaged individuals, including women, the disabled and the youth.

3.5.1. Identification of interested and affected parties

Interested and affected parties (I&APs) representing the following sectors of society was identified:

- National, Provincial and Local Authorities;
- Agriculture, including the local landowners;
- Community Based Organisations;
- Non-government Organisations;
- Water associations;
- Ward Councillors;
- Tourism;
- Industry and mining;
- Commerce, and
- Research institutions.

3.5.2. Public announcement of the project

The project was announced as follows:

- Publication of a media advertisement in the Diamonds Fields Advertiser DFA and the Kalahari Bulletin on the 14 June and 11 June 2013 respectively;
- on-site notices, advertising the EIA were placed along the border of the Farm property ;
- Distribution of letters by fax/post/email to I&APs ; and
- I&APs were given 30 days to comment and/or raise issues of concern regarding the proposed development.

3.5.3. Scoping Report

As mentioned in the previous section, all the issues raised during the announcement phase were captured within the Comment and Response Report which was attached to the Scoping Report. The EIA Regulations specify that I&APs must have an opportunity to verify that their issues have been captured. The Scoping Report was made available for public comment for a period of approximately four weeks (no less than 30 days). The availability of the Scoping Report was announced as follows:

- Letters announcing the availability of the Scoping Report was sent to all registered I&APs by e-mail, fax or post, approximately three weeks prior to the availability of the report.

In addition, the Scoping Report was distributed for comment as follows:

- Hard copy was placed at the Postmasburg Public Library;
- Posted on JOMELA's website at http://www.Jomela.co.za.

Comments on the Scoping report were obtained in the following way:

- Comment sheets were placed in the Scoping Report for I&APs to note their comments; and
- I&APs were also invited to e-mail, fax or phone their issues / concerns to JOMELA.

All comments received on the Scoping Report were incorporated into the Comments and Response Report which formed part of the Environmental Impact Assessment Phase.

3.5.4. Public Participation during the Environmental Impact Assessment Phase

Public participation during the Environmental Impact Assessment Phase of the EIA revolved around a review of the comments received during the Scoping Phase, findings of the EIA and inputs into the Environmental Management Plan (EMP). The findings were presented in a Draft Environmental Impact Assessment Report and EMP and the volume of specialist studies. The Draft EIA report was made available for public review from the 13th of November 2014.

3.5.7. Draft Environmental Impact Assessment (EIA) Report

The draft Environmental Impact Assessment Report will be made available for public review for a period of approximately four weeks (excluding school holiday) from from the 13th of November 2014. The availability of the Environmental Impact Assessment Report was announced as follows:

- An advert announcing the availability of the draft Environmental Impact Assessment Report was placed in the Postmasburg Register on the 20th of October 2014 and in the Diamond Fields Advertiser on the 22nd of October 2014 , approximately 2 weeks prior to the availability of the report;

- A hard copy of the draft Environmental Impact Assessment Report was placed at the Postmasburg Public Library;
- An electronic copy of the draft Environmental Impact Assessment Report was posted on the JOMELA website at http://www.Jomela.co.za;

All the issues raised by I&APs during the EIA phase will be captured in the Comment and Response Report and the I&APs will receive letters acknowledging their contributions.

Public Open House/Public Meeting

A Public Open House was conducted at the Tsantsabane Community Hall on the 13th of November 2014.

The purpose of the Open House was to:

- Describe the project and the process followed to date;
- Explain the motivation for the project;
- Indicate the study area and orientate attendants;
- Indicate the issues already identified through the public participation and bio-physical
- studies;
- Note new issues, concerns, questions and statements;
- Answer questions and explain concepts, and
- Register new Interested and affected parties (I&APs).

The objectives of the Public Open House were therefore to visually present the contents of the EIA Report and EMP; in order for I&APs to contribute issues of concern and/or suggestions for enhanced benefits and to contribute local knowledge to the project. I&APs will have the opportunity to meet with members of the Project Team and Environmental Impact Assessment (EIA) Technical Specialists to discuss any questions they may have in the language of their choice. All comment raised during the Open House have been included in the Comment and Response Report.

4. ASSESSMENT METHODOLOGY

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)

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.

4.1 ASSESSMENT OF BIOPHYSICAL AND CUMMULATIVE IMPACTS

Activities within the framework of the proposed development and their respective construction and operational phases, give raise 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.

4.2 ASSESSMENT CRITERIA

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

4.2.1. 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.

4.2.2. 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 or natural process will not occur in such a way or in such a time span that the impact can be considered transient,

4.2.3. 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.

4.2.4. 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:

a) 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%).

b) 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%.

c) 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%.

d) 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%.

e) 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%.

4.2.5. 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.

4.2.6. 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.

4.2.7. 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:

a) No significance

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

b) Low

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

c) 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.

d) 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.

e) 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.

f) 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.

4.2.8. 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.

4.2.9. Ranking, Weighting and Scaling

For each impact under scrutiny, a scale weighting Factor is attached to each respective impact (refer to Figure 17: 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 17: Description of biophysical assessment parameters with its respective weighting

4.2.10. 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

4.2.11. 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.

5. IDENTIFICATION AND ESTIMATION OF ENVIRONMENTAL IMPACTS AND CONCERNS

5.1 SCOPING OF POTENTIAL ISSUES

Scoping is widely regarded as a critical step in the Environmental Impact Assessment (EIA) process. Through scoping, significant issues which require further investigation are identified. Issues that are identified as having a potentially significant impact are carried forward into the Environmental Impact Assessment phase and subsequently the Environmental Management Phase.

The objective of the scoping phase was therefore:

- To evaluate (scope) all concerns raised by the I&APs as identified during the public participation process;
- Assess and identify important aspects of the affected environment;
- Assess the significance of identified environmental issues and subsequently the need for further impact assessments; and
- Identify the required terms of reference for the assessment of significant impacts during the Environmental Impact Assessment phase.

The identified impacts have been assessed in more detail in section 6 of the Environmental Impact Assessment Report.

Potential impacts resulting from the proposed development were identified using input from the following sectors:

- Views of interested and affected parties;
- Other similar developments in the region;
- Legislation; and
- Experience of the Environmental Assessment Practitioner (EAP).

The following key issues were identified during the Scoping process:

- Ground and surface water contamination. Soil erosion and increased surface water runoff;

- Socio-Economic Issues e.g. job creation for local residents and poverty relief;
- Floral destruction and Faunal displacement;
- The generation of dust and noise;
- Increased traffic activity;
- Change of land use; and
- Visual disturbance.

The key issues have been divided into Biophysical issues and Social issues and include the following:

Biophysical Issues:

- Impacts on water bodies in the surrounding environment;
- Impact on the rate of erosion;
- Impact on the volume of runoff;
- Impact on quality of surface water;
- Ground water contamination; and
- Flora destruction and Fauna displacements.

Social issues:

- Impact on aesthetic character of surrounding areas;
- Impact on sense of place;
- Dust and noise generation during the construction and operational phases of the proposed mine;
- Visual intrusion during construction and operational phases of the proposed mine;
- Impact on economic and employment status;
- Destruction of possible heritage sites; and
- Impact on infrastructure services.

A summary of the key issues is provided in Table 7: Summary of key issues and anticipated impacts below:

Further details associated with the construction and operation of the various activities as listed in the Project Description in the EIA Report. The EIA Report assessed the impacts of each of the activities as well as ascertains the cumulative impacts of the development in totality. The EIA

Report further outlined the necessary mitigation measures and defines any issues/areas which could be the cause for concern.

5.2 SUMMARY OF KEY ISSUES

Table 7: Summary of key issues and anticipated impacts

Key Issue	Relevant Area	Environmental Objective	Potential Impacts	Potential Mitigation
Ground and Surface Water Contamination	Regional	To prevent the contamination of the local and regional water.	Contamination of the local drinking water and possible contamination of the regional water supply. Contamination of boreholes.	Implementation of all recommendations as stipulated by the specialists, EMP, and mitigation measures of the EIA.
Change in Topography	Site	Limit the altering of the surrounding topography.	The topography will be altered by the presence of the box cuts.	Limit impacts on drainage and aesthetic quality of the environment. Return the area as far as possible to its original topography.
Soil erosion and increased surface water runoff	Site	To prevent increased soil erosion and surface water runoff as a result of vegetation clearance	Increased erosion and surface water runoff from hydrological systems in close proximity to the mining site as a result of vegetation clearance mainly during the operational phase	Implementation of all recommendations as stipulated by the specialist, EMP and mitigation measures mentioned during the EIA phase.
Change in Surface water quality	The importance of all water bodies (perennial and non-perennial and man-made) in maintaining the functioning of the associated catchment.	To ensure that the surrounding water resources are not adversely affected to the detriment of the health and welfare of nearby communities and ensuring suitable quality and quantity of water resources.	Potential increase in water river sedimentation, erosion and general pollution of surface water. Reduction in surface water flows. Diversion	Prevention of overspill of mine associated activities into the surrounding watercourses; Development of emergency management plans, regarding surface spillages; Prevent the release of contaminated water from the site to the surrounding environment.
Change in Geohydrological conditions	Region	To ensure the integrity of all underlying ground water thereby making sure that all water remains suitable for the purposes which it is currently being used for.	Pollution of underground water resources; Potential dewatering of underground aquifers; Altering of current water table depths.	Implementation of the necessary monitoring and management programs to ensure the integrity of all groundwater resources.

Floral destruction and Faunal displacement	Local	To prevent impacts on the area's local biodiversity, and loss of agricultural land.	Loss of the area's agricultural potential, and biodiversity.	Follow the recommendations and mitigation measures of the ecological specialists and EMP
Change of Land Use	Local	To prevent impacts on the area's local Agricultural Production.	Loss of the agricultural area's and agricultural production.	Implementation and adherence to the EMP.
The generation of dust	Local	To minimise negative impacts on the local and regional air quality as a result of blasting and construction activities.	Reduced air quality due to vehicle fumes, and blasting.	Implementation and adherence to the EMP, and blasting guidelines.
Decreased Air quality	Local	To minimise the extent of the generation of PM10 and Total Suspended Particulars (TSP) thereby minimising the aspect of nuisance and health impacts to sensitive receptors.	Potential increase in dust nuisance levels and health impacts from the generation of dust.	Dust suppression activities are required during the construction and operational phase in order to minimise dust generation; Air quality monitoring.
Increased Noise, vibration and shock	Local	To minimise the noise and vibration to a level that disturbances felt by the communities are limited.	Increase in continuous noise level; the disruption of current ambient noise levels and the disruption of sensitive receptors by means of increase noise and vibration.	Minimise the generation of excessive noise and vibration through the intelligent planning and construction of the proposed mine.
Visual Disturbance	Regional	To minimise light and visual pollution. To ensure that the development blends in with the landscape character and to maintain an uninterrupted skyline	Alteration to the landscape character	Strategic locations in order to minimise the visibility of structures; Utilisation of colours and materials which blend in with the natural landscape, minimise the use of lighting and select low intensity lighting; and Non-intrusive architectural design.
Increased Traffic Activity	Regional	To prevent congestion as a result of	Increased traffic on the surrounding road	Adherence to the EMP.

		the mine vehicles making use of the dirt road	networks	
Health and well-being	Regional	To mitigate the effects of the mine on the quality of the living environment	Decrease in the quality of living environment	Follow the mitigation measures as prescribed in the EMP.
Economic impacts and material well-being	Regional	To optimise the impact of the economic opportunities related to the construction and operational phases of the mine on the surrounding environment	Increased economic opportunities	Follow the mitigation measures as prescribed in the EMP.

6. DETAILED ENVIRONMENTAL IMPACT ASSESSMENT

6.1 WATER RESOURCES

6.1.1. Impact on ground water levels

Table 8: Impacts on dewatering of the groundwater aquifer

Activity	**Depletion of the underground aquifer** **Lowering of ground water levels**		
Nature of the impact	**Dewatering during operational phase of the mine**	Status	-
Receiving environment	**Underground aquifer**		
Magnitude	*Extent (footprint; site; regional; national; international)*		**REGIONAL**
	Intensity (low; medium; high)		**MEDIUM**
	Duration (short; short-med; medium; long; permanent)		**LONG TERM**
	Probability (Improbable; possible; likely; highly likely; definite)		**DEFINITE**
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**MEDIUM**
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**LOW**
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(3 + 3 + 4 + 5) x 3 = 45* *Medium*	
	With mitigation (WM)	*WOM x ME = WM* *45 x 1.0= 45* *Medium*	
Significance With Mitigation (WM)	**MEDIUM**		

Source of impact:

Open Cast mining operations on the Emang Mmogo site.

Description of impact:

Mining operations may lead to the dewatering of areas surrounding the main mining area during the operational phase of the mine. The dewatering of areas surrounding the ore body may in turn lead to the influx of water into the incline and areas below surface level, during the bulk sampling and operational phases of the Emang Mmogo mining operation. Ground water modelling should be undertaken to determine the influx of water into the box cuts.

Significance:

The Significance of the impact is assessed as medium.

Mitigations:

- Lineaments must be identified that can be responsible for the ingress of water. Boreholes must be drilled on lineaments to confirm the water bearing potential of these lineaments. Proper aquifer tests needs to be undertaken to qualify potential inflows of water into the mine workings;
- A hydro-census study must be undertaken to ensure that all ground water use in the area is taken into account in the EMP;
- Borehole information from the adjacent areas must also be taken into account and documented in the EMPR;
- Further slug and pumping tests on boreholes must be undertaken;
- A conceptual and numerical ground water flow model must be developed to address all impacts due to dewatering of opencasts and underground mining operations;
- Methods must be used to assess if there is a connections between surface water and ground water. The nature of the connection must be identified and qualified.

6.1.2. Ground and surface water contamination

Table 9: The impact on ground and surface water by migration of contaminated water from the mining operations

Activity	**Contamination of the underground aquifer and surface water resources**		
Nature of the impact	**Seepage from mining operations etc. and pollution form vehicles operating on site**	Status	-

Receiving environment	**Underground aquifer and surface water resources**		
Magnitude	*Extent (footprint; site; regional; national; international)*		**SITE**
	Intensity (low; medium; high)		**MEDIUM**
	Duration (short; short-med; medium; long; permanent)		**PREMANENT**
	Probability (Improbable; possible; likely; highly likely; definite)		**DEFINITE**
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**MEDIUM**
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**LOW**
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(3 + 3 + 4 + 5) x 3 = 45* *Medium*	
	With mitigation (WM)	*WOM x ME = WM* *45 x 1.0= 45* *Medium*	
Significance With Mitigation (WM)	**MEDIUM**		

Source of impact

Seepage from the stockpiles and from mining operations causes a contamination plume affecting the underground resources which in turn affects surface water resources. Contamination may also occur directly into surface watercourses.

Hydrocarbon-based fuels or lubricants spilled from construction vehicles.

Description of the impacts

Hydrocarbon-based fuels or lubricants spilled from construction vehicles, construction materials that are not properly stockpiled and litter deposited by construction workers may also be washed into the surface water bodies. Should appropriate toilet facilities not be provided for construction workers at the construction crew camps, the potential exists for surface water resources and

surroundings to be contaminated by raw sewage. The utilisation of the water courses for disposal of water used for washing will decrease the abundance and diversity of aquatic macro invertebrates inhabiting watercourses associated with the proposed development and further downstream. Contaminated runoff from concrete mixing and sediment release including hydrocarbon spillages may lead to the infiltration of toxicants into the groundwater.

Significance:

The significance is assessed to be medium.

Mitigation:

- To assess the impacts of the stockpile area on the groundwater regime a groundwater analysis need to be undertaken;
- A contaminant plume after 5, 10, 15, years should be modelled. Contaminated groundwater from the stockpile area will migrate and this assessment need to determine the direction and propose possible mitigation measures;
- The contaminant plume could result in an impact on downstream water bodies, aquatic ecosystems and surrounding landowners, especially in the long term (more than 50 years);
- Disposal of Manganese and Iron stockpile on natural clay;
- 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 bermed 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 Controlling Officer. These materials include fuel, oil, cement, bitumen etc.
- Surface water draining off contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils.
- All materials liable to spillage are to be stored in appropriate structures with impermeable flooring.

- Portable septic 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.

Table 10: Assessment of the possible impacts on surface water during the construction and operational phase

Activity	**Pollution of surface water**		
Nature of the impact	**Discharge and/or seepage of process water from the plant area.**	Status	-
Receiving environment	**Surface Watercourses and the Underground aquifer**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**HIGH**	
	Duration (short; short-med; medium; long; permanent)	**MEDIUM**	
	Probability (Improbable; possible; likely; highly likely; definite)	**LIKELY**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**LOW**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**HIGH**	
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 5+ 3+ 3) x 1 = 13* *Low*	

	With mitigation (WM)	*WOM x ME = WM* *13 x 0.2 = 2.6* *Low*
Significance With Mitigation (WM)	**LOW**	

Source of impact:

Discharge and or seepage of process water from the plant area.

Description of impact:

Construction phase:

Construction of the proposed mining infrastructure may generate dust and consequently silt in runoff water. However, the affected areas would be small (less than 80 ha), isolated and contained. The intensity (concentration) id expected to be low and the duration of the construction phase is relatively short. The probability of occurrence of silt runoff into surface water drainage features is considered negligible having a very low significance.

Operational phase:

Discharge and/or seepage on contaminated storm and process waters may cause silt and elevated concentrations of total dissolved solids in the water resources. The total area is small and the Mean Annual Runoff (MAR) and contaminated process waters will be contained in the lined return water dam. The intensity (concentration) is expected to be moderate albeit long (throughout operations) duration. The probability of occurrence of silt and increased total dissolved solids in discharge of contaminated runoff and/or process water into surface water drainage features is considered negligible (no more than once in 50 years) having a low significance (small volumes albeit at large concentrations but during excessive rainfall) and high confidence (greater than 80 percent). The duration of discharge is expected to be short (during extreme rainfall events). The probability of occurrence of increased total dissolved solids in seepage of contaminated process waters in water resources is considered moderate (30%) having a high significance and moderate confidence (70%).

Significance:

The overall significance of the impact on surface water resources is considered to be low. Mitigation measures are easily implemented and can further reduce the impact.

Mitigation:

- Prevention of overspill of mining activities, and associated activities into the surrounding streams and rivers. Implementation of the necessary monitoring and management programmes to ensure the integrity of all water resources in the area during the construction, and operational lifespan of the mine;
- Containment of return waters in a clay lined return water dam;
- Re-cycling of contaminated runoff waters from lined settling and evaporation dams;
- Sealing of process waters circuit and containment structures;
- Separate clean and dirty water systems; and
- Provide sufficient storage capacity to contain contaminated waters i.e. adopt a zero discharge policy.

Table 11: Destruction of Riparian Habitat

Activity	**Mining Activities and construction of an access road during the Bulk Sampling and Operational Phase**		
Nature of the impact	**Destruction of Riparian Habitat**	Status	-
Receiving environment	**Riparian zones on the Emang Mmogo Site**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**HIGH**	
	Duration (short; short-med; medium; long; permanent)	**PERMANENT**	
	Probability (Improbable; possible; likely; highly likely; definite)	**LIKELY**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**HIGH**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**MEDIUM**	
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 5+ 5+ 3) x 5 = 75* *Medium - High*	
	With mitigation (WM)	*WOM x ME = WM* *75 x 0.6 = 45* *Medium*	

Significance With Mitigation (WM)	**MEDIUM**

Source of impact:

Mining Activities and construction of an access road

Description of impact:

Watercourses in the region of the study site shelters several sensitive faunal and invertebrate species. Cumulative disturbance of the natural vegetation cover in the Riparian areas and also in the surrounding landscape will result in the eventual loss of this habitat type, and consequently to the loss of the species dependant on the vegetation cover.

Significance:

The overall significance of the impact on the Riparian habitats is considered to be medium after the implementation of mitigation measures.

Mitigation:

- No mining activities should take place within buffered the Riparian areas or in their associated buffer zones.
- Riparian areas and their associated buffer zones should be fenced during the construction phase to prevent any human activity from encroaching onto these areas.
- Riparian areas outside the study area that are affected by access to the site by machinery and the labour force should also be fenced off and protected.
- No animals may be trapped, hunted or handled in any way.
- No vegetation may be collected or used for firewood.

Table 12: Altered Hydrological Regime

Activity	**Mining Activities during the Bulk Sampling and Operational Phase**		
Nature of the impact	**Altered Hydrological Regime**	Status	-
Receiving environment	**Water resources associated with the Emang Mmogo site**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**HIGH**	

	Duration (short; short-med; medium; long; permanent)		**LONG**
	Probability (Improbable; possible; likely; highly likely; definite)		**HIGHLY LIKELY**
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**HIGH**
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**MEDIUM**
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 5+ 4+ 4) x 5 = 75* *Medium - High*	
	With mitigation (WM)	*WOM x ME = WM* *75 x 0.6 = 45* *Medium*	
Significance With Mitigation (WM)	**MEDIUM**		

Source of impact:

Mining activities.

Description of impact:

The location of the study site in relation to the catchment area of water bodies surrounding the study site mean that the proposed Manganese and Iron mining activities potentially expose surrounding water users to severe water quality concerns.

Significance:

The overall significance of the impact on the hydrological regime is considered to be medium after the implementation of mitigation measures.

Mitigation:

- In order to minimise artificially generated surface storm water runoff, total sealing of paved areas such as parking lots, pavements and walkways should not be permitted. Permeable material should rather be utilized for these purposes.
- Establish water quality parameters before mining activities commence which can serve as future benchmark data against which regular water quality monitoring can be measured to determine the impact of the mining activities on the regional aquatic resources.

- Implement an ecologically-sensitive storm water management plan that includes not allowing storm water to be discharged directly into the identified buffer zone of the Riparian area.

6.2 AIR QUALITY

6.2.1. Air Quality

Table 13: Assessment of the possible impacts on air quality during the construction and operational phase

Activity	**Atmospheric pollution associated with Manganese and Iron transport, waste stockpiles, uncontrolled spillages, disturbed land and vehicles on un-surfaced roads. Emissions from ventilating systems.**		
Nature of the impact	**Pollution and nuisance from dust emissions.**	Status	-
Receiving environment	**The immediate and surrounding land owners**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**REGIONAL**	
	Intensity (low; medium; high)	**MEDIUM**	
	Duration (short; short-med; medium; long; permanent)	**LONG-TERM**	
	Probability (Improbable; possible; likely; highly likely; definite)	**HIGHLY LIKELY**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**LOW MEDIUM**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**MEDIUM HIGH**	
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(3 + 3+ 4+ 4) x 2 = 28* *Low to Medium*	
	With mitigation (WM)	*WOM x ME = WM* *28 x 0.4 = 11.28* *Low*	
Significance With Mitigation (WM)	**LOW**		

Significance

- Materials Handling Operations:

Materials handling operations associated 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. A temporary storage pile will be located near the mining process and heavy vehicles will transport materials from this stockpile area to the processing plant.

- Wind erosion from exposed areas:

The source that was identified to be significantly prone to wind erosion was the stockpile area. However, studies at other mines have also indicated that the topsoil and overburden stockpiles will be affected.

- Vehicle activity on paved roads:

The client intents to make use of 60 000t/m vehicles to transport material to the process plant area. Currently there is not a lot of vehicle movement on the portion identified for mining, although areas to the southeast (near the silos) are affected by vehicles accessing and leaving the Manganese and Iron loading site. These vehicle movements generate dust which contributes to the overall air quality in the area.

- Synopsis of Particulate Emissions from various sources:

Dust emissions from material handling represent the largest source of emissions, constituting 87% of the total TSP emissions and 84% PM10. Wind erosion of open areas is calculated to contribute 12% of total TSP fugitive dust emissions and 9% to PM10. Dust generated from processing was found to comprise generally less than 5% of the total TSP and PM10 fugitive dust emissions. Paved roads are the least contributing source to both TSP and PM10, with emissions being less than 1% of the total TSP en PM10 fugitive dust emissions.

Description of the impact:

Dust emissions will impact on the ambient air quality of the region and contribute to cumulative impacts of mine activities on the air quality (cumulative impacts are discussed in a later section).

Significance:

- PM10

The predicted mitigated daily average ground level concentrations for the proposed operations at the Emang Mmogo open cast Manganese and Iron mine is not expected to exceed the current daily South African standard of 180µg/m^3 or the proposed South African standard of 75µg/m^3 at the mine boundary or at the sensitive receptor sites surrounding the mine.

The predicted annual average ground level concentrations for the proposed Emang Mmogo open cast Manganese and Iron mine do not exceed the current annual South African standard of 60µg/m^3 and the proposed South African standard of 40µg/m^3 outside the mine boundary.

- Dust Deposition

The predicted mitigated maximum daily dust deposition rates for the proposed operations do not exceed the SANS residential dust fallout limit of 600mg/m^2/day and the SANS annual target threshold of 300mg/m^2/day at all the sensitive receptor sites surrounding the proposed mine.

Mine operations (stockpiling and processing) were identified as having the most significant potential for air pollution however with the implementation of mitigation measures as recommended in the EMP will significantly reduce the impact. The roads in the study area are to be tarred so as to reduce the impact of dust associated with movement of vehicles on dirt roads. The impact of air quality as a result of materials handling on conveyors is not expected to pose an impact because the conveyors will not be used for the larger mining area.

Mitigation:

Dust suppression activities are required during the construction and operational phase in order to minimise dust generation. Air quality is a requirement as per the EMP.

6.3 FLORA AND FAUNA

6.3.1. Destruction of Flora and Fauna

Table 14: Destruction of sensitive vegetation types and protected plant and animal species

Activity	Impacts on Rare and Endangered Flora and Fauna

Nature of the impact	**Vegetation clearance, habitat destruction and disruption of natural behaviour**		Status	-
Receiving environment	**Faunal and Floral Species located on site**			
Magnitude	*Extent (footprint; site; regional; national; international)*		**SITE**	
	Intensity (low; medium; high)		**HIGH**	
	Duration (short; short-med; medium; long; permanent)		**PERMANENT**	
	Probability (Improbable; possible; likely; highly likely; definite)		**PROBABLE**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**LOW MEDIUM**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**LOW MEDIUM**	
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 5+ 5+ 1) x 2 = 26* *Low to Medium*		
	With mitigation (WM)	*WOM x ME = WM* *26 x 0.4 = 10.4* *Low*		
Significance With Mitigation (WM)	**LOW**			

Source of impact:

- The clearance of vegetation on the proposed site during construction of mining infrastructure such as the plant area, change houses, offices and workshops.
- Clearing of vegetation for the construction of roads from the box cut and open cast operations and the processing area;
- The clearing of vegetation for the construction camp, temporary access onto the site, spoil areas, materials storage and topsoil stockpiles.

Description of the impact:

Construction will destroy natural vegetation and alter the habitat in such a way that species cannot colonise the area. This could lead to certain species becoming rare in the local context.

Significance

Overall the site is poorly conserved with large portions utilised for agricultural purposes including maize farming. The agricultural fields are separated by open savannah patches, in which numerous small mammal and bird species are present. In light of the fact that most of the site is disturbed and fragmented and has been converted to farmland in the past or is currently under cultivation the proposed mining operations will not have a significant detrimental impact on the terrestrial ecology of the site.

The development of the Emang Mmogo (Pty) Ltd surface infrastructure will result in a loss of plant and animal habitats at the site of the surface infrastructure. Unnecessary habitat disturbance by the Emang Mmogo (Pty) Ltd mining and processing activities will be limited and contained to the construction area.

The area surrounding the proposed mining operations has been fragmented by linear infrastructure such as roads, railway lines and other land uses such as agriculture. Fragmentation of plant habitats can lead to attrition of the communities occupying these habitats. Vehicles travelling off road can lead to further fragmentation of plant habitats.

Disturbed land is susceptible to colonisation of invader species. The invader species can spread on to surrounding land and disrupt natural plant communities. Timeous rehabilitation of disturbed land is required to reduce the potential for invader species to proliferate on the land. Care should also be taken to ensure that species used in rehabilitation programmes are not invasive.

Plant and animal communities are likely to be adversely affected by contamination of habitats. Contamination of water on site is of greatest concern in this respect and could result in a decrease in the diversity of communities in the aquatic and riparian zones if not managed properly.

Mitigation:

- Prevention of overspill of the mining activities onto the surrounding environment by making sure that clearance is only confined to the proposed site;
- Power line pylons should, as far as possible, not be placed in areas where erosion has already occurred or is likely to occur as this may exacerbate the problem;
- Power line pylons should preferably not occur in Riparian zones, rivers and streams or dry watercourses or within the 1:100 years flood line of any of these;

- Access roads should be kept to a minimum, and where possible existing tracks should be used;
- New access roads should be aligned so as to remain on the flattest terrain possible for as long as possible;
- Roads should not be constructed in Riparian zones, rivers or streams or dry watercourses or within the 1:100 years flood line of any of these unless no other alternative can be found. Where roads must be constructed through these areas, sufficient culverts should be provided to allow water to flow through;
- Construction vehicles should remain only in the area to be disturbed by the road and other works at the time. Disturbance should be restricted to the actual project area;
- The use of herbicides should be limited as far as possible. Herbicides should only be used under strict control and only when no other options are available. Herbicides should not be used near sensitive environments especially Riparian areas;
- Materials such as sand and stone should, wherever possible, be sources from areas which are free of alien plants;
- An important aspect of ongoing maintenance is the monitoring of the rehabilitated sites and access road verges for alien plant species; and
- Should alien plant species be identified then these should immediately be removed.

6.3.2. Destruction of Habitat

Table 15: Destruction of natural habitat

Activity	**Construction and operational activities**		
Nature of the impact	**Vegetation clearance and habitat destruction**	Status	-
Receiving environment	**Emang Mmogo Site**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**MEDIUM**	
	Duration (short; short-med; medium; long; permanent)	**PERMANENT**	
	Probability (Improbable; possible; likely; highly likely; definite)	**LIKELY**	

Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**LOW MEDIUM**
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**LOW MEDIUM**
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 3+ 5+ 3) x 2 = 26* *Low to Medium*	
	With mitigation (WM)	*WOM x ME = WM* *26 x 0.4 = 10.4* *Low*	
Significance With Mitigation (WM)	**LOW**		

Source of impact:

- The clearance of vegetation on the proposed site during construction of mining infrastructure such as the plant area, change houses, offices and workshops.
- Clearing of vegetation for the construction of roads from the box cut and open cast operations and the processing area;
- The clearing of vegetation for the construction camp, temporary access onto the site, spoil areas, materials storage and topsoil stockpiles.

Description of the impact:

Due to the nature of the construction activities across the site, even with mitigation much of the existing natural habitat will be destroyed. Heavy motor vehicle usage over the study site and adjacent land will expose the soils on the site to erosion and compaction. This will have a negative effect on the terrestrial ecosystems and Riparian areas in that siltation and habitat fragmentation could occur. It should however be noted again that a large proportion of the site is currently cultivated and only a small percentage of natural habitat remains on site.

Significance

It should however be noted again that a large proportion of the site is currently cultivated and only a small percentage of natural habitat remains on site. The significance of this impact with mitigation measures is thus given as low.

Mitigation:

- Cordon off the sensitive vegetation (hydrophilic and primary grassland) to restrict the movement of construction vehicles and construction personnel.
- Construction areas should be inspected for any occurrence of erosion. Appropriate remedial action (rehabilitation) must be undertaken should any eroded areas be identified.
- Areas designated as sensitive should be incorporated into an open space system which must be managed in accordance with an Environmental Management Plan.
- A comprehensive surface runoff and storm water management plan should be compiled, indicating how all surface runoff generated as a result of the development (during both the construction and operational phases) will be managed.
- No development should take place within any area demarcated as sensitive.

6.3.2. Reduction of Natural Migratory Routes

Table 16: Reduction of natural migratory routes and faunal dispersal routes

Activity	**Construction and operational activities -Vegetation clearance and habitat destruction**		
Nature of the impact	**Fragmented Landscape**	Status	-
Receiving environment	**Emang Mmogo Site**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**REGIONAL**	
	Intensity (low; medium; high)	**MEDIUM**	
	Duration (short; short-med; medium; long; permanent)	**LONG**	
	Probability (Improbable; possible; likely; highly likely; definite)	**LIKELY**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**LOW MEDIUM**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**LOW MEDIUM**	

Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(3 + 3+ 4+ 3) x 2 = 26* *Low to Medium*
	With mitigation (WM)	*WOM x ME = WM* *26 x 0.4 = 10.4* *Low*
Significance With Mitigation (WM)	**LOW**	

Source of impact:

- The clearance of vegetation on the proposed site during construction of mining infrastructure such as the plant area, change houses, offices and workshops.
- Clearing of vegetation for the construction of roads from the box cut and open cast operations and the processing area;
- The clearing of vegetation for the construction camp, temporary access onto the site, spoil areas, materials storage and topsoil stockpiles.

Description of the impact:

The grassland vegetation on site provides habitat for faunal species and links the area with other areas of open space. They are therefore able to provide important migration corridors and dispersal patterns for faunal species by linking various sections of open land that would otherwise be fragmented from one another. Should construction occur, the possibility that the connectivity between areas of open space and therefore the migration corridor, would be lost, is high.

The Riparian area on site furthermore provide unique habitat for faunal species and links the aquatic and terrestrial areas with other areas of open space. They are therefore able to provide important migration corridors for faunal species by linking various sections of open land that would otherwise be fragmented from one another. Should construction and mining occur, the possibility that the connectivity between these Riparian areas, and therefore the migration corridor, would be lost is high.

Mitigation:

- The Ecological assessment conducted in terms of the Emang Mmogo site suggests the demarcation of ecological corridors to link sensitive habitats. This should be

implemented where possible and where agricultural activities have not impacted on the natural environment.

6.4 NOISE

6.4.1. Increased Noise and vibration

Table 17: Assessment of the possible impacts on Noise and Vibration during the construction and operational phase

Activity	**Noise generation on site during the construction and operational phase**		
Nature of the impact	**Blasting and construction activities which generate noise that exceeds the current ambient noise levels experienced over the site and surrounding areas**	Status	-
Receiving environment	**Machine operators and workers, surrounding communities**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**REGIONAL**	
	Intensity (low; medium; high)	**LOW**	
	Duration (short; short-med; medium; long; permanent)	**LONG-TERM**	
	Probability (Improbable; possible; likely; highly likely; definite)	**HIGHLY LIKELY**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**LOW MEDIUM**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**MEDIUM HIGH**	
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(3 + 1+ 4+ 4) x 2 = 24* *Low to Medium*	
	With mitigation (WM)	*WOM x ME = WM* *24 x 0.4 = 9.6* *Low*	
Significance With Mitigation (WM)	**LOW**		

Source of the impact:

Possible sources of disturbing noise of the Emang Mmogo (Pty) Ltd are listed in table 14. Of these sources, those with the greatest potential to be disturbing are:

- Increase noise levels from vehicular traffic and other equipment associated with the construction of the proposed mine; and
- Vibrations and noise associated with blasting.

Table 18: Possible sources of noise at the Emang Mmogo Mineral Resources (Pty) Ltd Emang Mmogo mine and the potential affected parties.

Process	Noise source	Mitigation
Mine workings	Drilling, blasting, loading and hauling	Hearing protection provided
Waste dumps	Dumping and falling of rocks	Residual sound levels are less than 60dBA at a distance of 100m from the noise source
Transport	Cars, busses and other heavy vehicles	Silencers
Villages, hostels and settlements	General domestic activity	

Description of the impact

Noise levels within the mining lease area are expected to range from 40 dBA to 50 dBA in the agricultural and residential areas, to be between 60 dBA and 70 dBA in areas where the predominant activity is mining related. Sensitive environments e.g. schools and churches; situated near the mining activities may be disturbed by these noise levels. Noise levels outside the mining lease area are expected to be lower than within it.

Considering the general trend whereby sound power levels decrease by 6 dBA with every doubling of distance from the source, it is expected there will be a significant decrease with an increase in distance beyond 50m from the noise source.

Machine operators and workers who work in the noise zones and / or with the noise sources above 85 dBA, and who do not wear approved hearing protection, will suffer permanent hearing loss.

Significance:

- The activity will have moderate significance on the surrounding environment. A blasting schedule will be implemented so that blasting occurs once a day at 4pm.

Mitigation:

- Ensure that all machinery and vehicles are well maintained and road worthy;
- Noise at equipment and machinery point source should be damped through acoustic treatment and applying silencing equipment;
- Environmental noise monitoring should be carried out at regular intervals to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted;
- Regularly conduct noise audits on site;
- Erect warning signs where noise levels exceeds 85 dBA noise levels;
- Atmospheric conditions should be considered before charging and blasting;
- Blasting vibrations should be controlled by means of optimising blast hole geometry and altering the time of blasting;
- Implement a dust and noxious gases minimisation strategy that will reduce the impact of atmospheric pollution. This will include the use of noxious gas fixation techniques, using and adhering to blasting schedules, and strategies that minimise dust generation;
- Affected communities must be notified when blasting is scheduled to take place;
- Workers must be issued with the necessary protective equipment, including ear plugs, when working in conditions that may progressively have detrimental effects on their health. Ensure that all personnel have access to hearing protection equipment at site where the 85 dBA noise level is frequently recorded. Issuing of hearing protection will conform to the Emang Mmogo(Pty) Ltd strategy'
- All employees, who operate machines / tools which are identified as noise sources, should be subjected to audiometric examinations;
- All hand held machinery will be muffled;
- All fans to be silenced;

- If complaints about disturbing noise are received from the local community, Emang Mmogo(Pty) Ltd will:
    - Respond immediately to the complaints;
    - Identify the noise source;
    - Implement appropriate mitigatory measures in consultation with the affected party;
    - The responsible environmental officer will investigate all complaints and /or non-compliances and the necessary actions will be taken.

6.5 VISUAL IMPACT

6.5.1. Change in Visual character of the area

Table 19: Assessment of the possible impacts on visual aspects

Activity	**Construction of mining related infrastructure and visibility of mining structures**		
Nature of the impact	**Disturbance of existing aesthetic environment as a result of visibility of the overburden stockpiles and other mine infrastructure**	Status	-
Receiving environment	**Visual receptors such as the surrounding communities**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**REGIONAL**	
	Intensity (low; medium; high)	**MEDIUM**	
	Duration (short; short-med; medium; long; permanent)	**LONG**	
	Probability (Improbable; possible; likely; highly likely; definite)	**HIGHLY LIKELY**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**MEDIUM**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**LOW**	
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(3 + 4+ 3+ 4) x 3 = 42* *Medium*	
	With mitigation (WM)	*WOM x ME = WM* *42 x 1 =42* *Medium*	

Significance With Mitigation (WM)	**MEDIUM**

Source of the impact:

The risk sources during the construction phase can be considered to be as follows:

- The image of the construction activity could lead to a perceived view of progress and benefit to the community;
- Excessive cleaning and stripping of topsoil for site offices, servitudes and access roads;
- The relative random and disorganised lay down of building materials, vehicles and offices;
- Cut and fill slopes of roads will become highly visible if not re-vegetated and shaped to blend in with existing topography;
- Dust from construction vehicles;
- Open and rehabilitated landscape scarring;
- Location and layout of construction workers camp if located in proximity of works area; and
- The construction of the access roads, surface infrastructure and opencast mining.

All infrastructure relating to mining operations are familiar landmarks within the region. Parts of mine infrastructure notably the overburden stockpile, rock dumps, and other infrastructure may be noticeable from further offsite.

Residential communities in the surrounding area will also be impacted by the visual intrusion. The risk sources during the operational phase can be considered as follow:

- Dust from heavy vehicles;
- Open and rehabilitated landscape scarring;
- Stockpile areas; and
- The operations associated with the access roads, surface infrastructure and opencast mining.

On closure of the mine, the only structures that will remain will be the vegetated open fields and remaining buildings which could be utilised.

Description of the impact:

Table 18 below rates each criteria from high, medium to low according to the specific characteristics of those criteria Table 16 lists for each project component the visual criteria rating and the visual impact of the component on these areas.

Table 20: Visual Assessment Criteria (VAC) ratings

	CRITERIA	HIGH	MEDIUM	LOW
1	Visibility	Very visible from many places beyond 1000 meter zone.	Visible from within the 1000 meter zone but partially obscured by intervening objects.	Only partially visible within the 1000 meter zone and beyond due to screening by intervening objects.
2	Genius Loci	A particular definite place with an almost tangible dominant ambience or theme.	A place, which projects a loosely definite theme or ambience.	A place having little or no ambience with which it can be associated.
3	Visual Quality	A very attractive setting with great variation and interest but no clutter.	A setting, which has some aesthetic and visual merit.	A setting, which has little aesthetic value.
4	Visible social structure	Housing and / or other structures as a dominant visual element.	Housing and / or other structures as a partial visual element.	Housing and / or other structures as a minor visual element.
5	Surrounding Landscape Compatibility	Ideally suits or matches the proposed development.	Can accommodate the proposed development without appearing totally out of place.	Cannot accommodate the proposed development without it appearing totally out of place visually.
6	Character	The site or surrounding area exhibits a definite character.	The site or surrounding area exhibits some character.	The site or surrounding area exhibits little or no character.
7	Scale	A landscape which has horizontal and vertical elements in high contrast to the human scale.	A landscape with some horizontal and vertical elements in some contrast to the human	Where vertical variation is limited and most elements are related to the

			scale.	human and horizontal scale.
8	Visual Absorption Capacity	The ability of the landscape to easily accept visually a particular development because of its diverse landform, vegetation and texture.	The ability of the landscape to less easily accepts visually a particular development because of a less diverse landform texture and vegetation.	The ability of the landscape not to visually accept a proposed development because of a uniform texture, flat slope and limited vegetation cover.
9	View Distance	If uninterrupted view distances to the site are > than 5 km.	If uninterrupted view distance are < 5 km but > 1 km.	If uninterrupted view distances are >500m and < 1000m.
10	Critical Views	Views of the projects are to be seen by many people passing on main roads and from prominent areas i.e. communities and settlements.	Some views of the project from surrounding main roads and communities.	Limited views to the project from main roads and communities.

Table 21: Site evaluation

CHARACTERISTICS	VISUAL CRITERIA RATING	VISUAL IMPACT
Visibility	Medium to High	Moderate
Genius Locci	Medium to Low	Moderate
Visual Quality	Medium to Low	Low
Social	Medium to High	Low
Surrounding landscape compatibility	Medium to Low	Low
Character	Medium to Low	Moderate
Scale	High	Low
VAC	Medium to Low	Moderate
View Distance	High	Low
Critical Views	High	Low

The result show that Emang Mmogo Mineral Resources (Pty) Ltd has, 4 moderate and 6 low visual impact ratings.

The Emang Mmogo Mineral Resources (Pty) Ltd mine will exert a moderate negative influence on the visual environment. This is largely due to:

- High visibility of construction activity within a zone of uniform visual pattern;
- The low visual absorption capacity of the setting which is attributable to:
    - The low vegetation height (less than one meter);
    - The lack of visual diversity; and
    - A general lack of rising landforms as a backdrop.
- The size of the operations will expose it to many viewers; and
- The need to cut across or expose the existing landforms to accommodate the surface infrastructure.

Significance:

The significance of the impact is assessed to be low to medium.

Mitigation:

- Effective planning of the location of the mine infrastructure and lighting to minimise visual impact and light pollution;
- Screen the mine infrastructure from the surrounding roads and properties using, for example trees;
- The illumination of Emang Mmogo Mineral Resources (Pty) Ltd operations should be focussed yet bear in mind safety and security issues. The design should make provision for accent lighting which should be downward to prevent light pills skywards;
- Selective and sensitive location and design of the lighting requirements for the Emang Mmogo Mineral Resources (Pty) Ltd operations is required. For instance reduce the height from which floodlights are fixed and identify zones of high and low lighting requirements with the focus of the lights being inward rather than outward;
- The building textures and colours should not contrast vividly with the backdrop of colour and textures provided by the landscape. The natural setting and colours of buff, olive greens, dark brows should be respected and where possible, these should be incorporated into the materials used in the exteriors of the buildings and landscape;
- Colours of new infrastructure should be matt, not glossy so as to reduce reflection and glare from the surfaces. This is important when considering the night scene and reflected lights;

- The land forming and planting design of Emang Mmogo Mineral Resources (Pty) Ltd should respect the surrounding indigenous vegetation. The interface between new planting and the existing should be gradually blended. Plant material around the main structures can be exotic, colourful and lush, however on the fringes of these areas the planting material should tend more towards local indigenous species of trees and grassland;
- The building forms should be broken by roof overhangs and steps in the façade. This will create shadow lines which, in turn, assist in the mottling breaking up of the visible plant form;
- The requirements for stabilisation of new landforms must be considered so that effective rehabilitation and re-vegetation can be timeously and effectively implemented. This will be determined by slope, access, material, climate etc.

6.6 TERRESTRIAL IMPACTS

6.6.1. Soil Erosion and increased surface runoff

Table 22: The impact of vegetation clearance and topsoil stripping on soil erosion and surface water runoff

Activity	**Soil erosion during the construction and operation phases**		
Nature of the impact	**Vegetation clearing, topsoil stripping, site establishment, movement of people and vehicles on site**	Status	-
Receiving environment	**Soil structures and adjacent water resources**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**MEDIUM**	
	Duration (short; short-med; medium; long; permanent)	**SHORT - MEDIUM**	
	Probability (Improbable; possible; likely; highly likely; definite)	**POSSIBLE**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**LOW TO MEDIUM**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**MEDIUM HIGH**	

Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 3+ 2+ 2) x 2 = 18* *Low*
	With mitigation (WM)	*WOM x ME = WM* *18 x 0.4 =7.2* *Low*
Significance With Mitigation (WM)	**LOW**	

Source of the impact:

The clearance of vegetation and stripping of topsoil to make way for the establishment of mine related infrastructure and structures associated with the various proposed development components.

Description of the impact:

During construction it will be necessary to clear portions of vegetation, where the development will be undertaken. The construction sites will need to be levelled, which will alter the natural soil structure. The major impact of vegetation clearance is the exposure of soil to the agents of erosion, such as wind and water.

Large volumes of spoil material will be generated during the construction phase whilst some of the material will be re-used for fill elsewhere on site, the spoil material generated will also be vulnerable to the agents of erosion, such as wind and water.

Erosion can be expected if construction occurs within the rainy season and therefore may result in the loss of topsoil from topsoil stockpiles. The clearance of vegetation will reduce the capacity of the land surface to limit the flow of surface water, thus decreasing infiltration, and increasing both the quantity and velocity of surface water runoff and causing erosion.

Significance of the impact:

Topsoil normally has a high nutrient content and is an indigenous seed bank. It is considered to be a national resource of value to current and future generations. It may be lost through the establishment of infrastructure on the soil and through the development excavations. A loss of topsoil will result in a decrease in the productivity of land.

Conservation of topsoil requires attention. Long-term bulk storage of topsoil will degrade the soil fertility, texture and structure. The following factors that cause degradation include:

- Erosion;
- Compaction;
- Loss of nutrients by leaching and anaerobiosis; and
- Decline in essential biological activity.

Mining related activities will disturb land and damage the vegetation that shelters and binds soils. The exposed soils will be more susceptible to erosion by wind and water. Erosion can affect all living organisms through the destruction of habitats, loss of valuable topsoil, which reduces the productivity of the soils, contamination of water with suspended solids and contamination of air with dust. Erosion can also reduce the aesthetic quality of the environment. Among the activities at Emang Mmogo that could cause erosion is the construction of infrastructure (such as new buildings, roads, power lines, pipelines and various facilities for the handling of waste and polluted components).

Off road movement of vehicles can cause extensive erosion – one trip across the veld is enough to damage vegetation and initiate the erosion process. Unsurfaced access roads are highly susceptible to erosion. Footpaths are also prone to erosion particularly where there is concentrated pedestrian traffic.

Erosion may be accelerated where water is channelled by linear infrastructure (such as roads and railway lines, power lines and pipelines) and surface water management infrastructure (such as canals and bunds). Erosion may also be accelerated at points where there are concentrated discharges of water to the environment (such as at culverts, outflows of run off etc.). Mine residue deposits at Emang Mmogo include the overburden stockpile. Materials eroded from these deposits could polluted water and air. The contaminants in the water and air could be transferred to soil.

The extent of the impact is on site during the construction phase. The impact is given a medium intensity rating as vegetation growth and other natural processes would continue in areas around the erosion. The duration would be medium term, since erosion would be discontinued once vegetation has established. The weighing factor attributed to this impact is low-medium and significance of the impact with mitigation is thus low.

Mitigation:

- The implementation of anti-erosion measures such as construction of berms to reduce the velocity of surface water run-off is essential;
- By maintaining the maximum amount of vegetated area on site, the extent of erosion and ecosystems loss can be contained;
- Topsoil and subsoil must be kept totally separated during excavation and must be stored in separate stockpiles;
- It is also imperative that the topsoil layer be retained and used in facilitating the reinstatement of indigenous vegetation;
- Trench areas must be raised to accommodate the bulking factor and subsidence;
- When soil is replaced excavation and installations should be carried out when the soil is at its driest, where possible;
- All access roads must be demarcated, and existing roads must be used as far as possible for the hauling of materials; and
- Disturbed surfaces to be rehabilitated must be ripped, and the area must be backfilled with topsoil over overburden and approximately re-vegetated

6.6.2. The potential for soil pollution

Table 23: Soil pollution

Activity	**Improper disposal of paints, cement bags and other building wastes during the construction phase, as well as inappropriate storage and handling of hazardous substances (including fuels and lubricants**		
Nature of the impact	**Contamination of soil through direct contact between hazardous and toxic materials and bare soil surfaces as well as through seepage of leachates from the mine residue deposits**	Status	-
Receiving environment	**Bare soil surfaces**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**HIGH**	

	Duration (short; short-med; medium; long; permanent)		**SHORT - MEDIUM**
	Probability (Improbable; possible; likely; highly likely; definite)		**LIKELY**
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**LOW**
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**HIGH**
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 5+ 2+ 3) x 1 = 12* *Low*	
	With mitigation (WM)	*WOM x ME = WM* *12 x 0.2 =2.4* *Low*	
Significance With Mitigation (WM)	**LOW**		

Source of impact:

The accidental spillage of hazardous materials such as fuels, oils and hydraulic fluids, paints and bitumen based products, as well as cement, are an unfortunate reality on large scale developments. Incorrect management and handling of the aforementioned substances ca also result in unnecessary spillages thereof. Fuel and oil leaks from poorly maintained plant and vehicles can also contribute to soil pollution.

Soils on the Emang Mmogo premises and surrounding land could also be contaminated in four main ways:

- Failures of mine residue deposits or pollution control measures;
- Contamination of water;
- Contamination of air; and
- Seepage from mine residue deposits.

Of the above modes of soil contamination the contamination of water is of most concern. The issue of leachates from mine residue deposits is generally addressed in the section on water resources, which cover seepage intro surface into surface and groundwater from the deposits.

Description of the impact:

Contamination of soils as a result of accidental spillages will alter the chemical properties of the affected soils and negatively influence the future growth of vegetation on these soils. Surface water run-off over contaminated areas can also transfer pollutants into ground and water resources, thus contributing to the potential contamination thereof.

Significance of impact:

The extent of the impact is on the site during the construction phase. The impact is given a high intensity rating due to the potential thereof to contribute towards ground and surface water pollution of nearby water resources. The duration would be over the short to medium term, since the potential for soil pollution will persist throughout the construction period. The weighting factor attributed to this impact is low and significance of the impact with mitigation is thus also low.

Mitigation:

- The concrete bathing site (if required) will be appropriately rehabilitated;
- A 'Hazardous materials spillage contingency plan' should be in place;
- All hazardous materials stored on site should also be stored in an appropriately bunded and well ventilated area;
- All contaminated soils should be immediately removed and placed within a hazardous skip located on site, for end disposal at an appropriately licensed hazardous waste disposal site by a reputable waste disposal contractor;
- All construction vehicles and plant machinery operating on site should be regularly serviced in order to prevent the potential for oil and fuel leaks to occur;
- Drip trays should be placed under vehicles that stand within the contractors yard for extended periods of time; and
- Vehicles should not be serviced out of terrain, but only in designated workshops established for the purposes that are equipped with oil water separators and sumps for the collection of contaminated materials.

6.7 HERITAGE IMPACTS

6.7.1. Potential Impacts on Heritage Resources

Table 24: The impacts of the development on heritage resources

Activity	**Construction of the mine and associated infrastructure**		
Nature of the impact	**Disturbance of historical and cultural resources**	Status	-
Receiving environment	**Elements of cultural or historic significance as well as the surrounding communities**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**MEDIUM**	
	Duration (short; short-med; medium; long; permanent)	**SHORT - MEDIUM**	
	Probability (Improbable; possible; likely; highly likely; definite)	**IMPROBABLE**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**LOW**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**HIGH**	
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 5+ 2+ 3) x 1 = 12* *Low*	
	With mitigation (WM)	*WOM x ME = WM* *12 x 0.2 =2.4* *Low*	
Significance With Mitigation (WM)	**LOW**		

Source of the impact:

- Damage to elements of cultural history, uncovering and subsequent damage to architectural finds during excavations and earthworks on site.

A Heritage Impact Assessment (HIA) of the site has been undertaken .Based on what was found and its evaluation, it is recommended that the proposed development can continue in the area (in terms of the proposed development intention having a low negative impact on elements of heritage significance). It is based on the current site conditions that there are no significant artefacts on the site. Should any artefacts of significance be unearthed during the construction or operational phase, activities will cease and a specialist from the Natural Cultural Heritage Museum will assess the site and the impact of the development on the historical artefacts.

Significance of the impact:

The extent of the potential impact is contained within the boundaries of the site. The impact is given as a Low intensity rating and could possibly occur, but is unlikely.

Mitigation:

The mitigation and management measures as set out in the specifications for a HIA should be applied prior to development taking place, namely:

- No blasting with explosives or heavy drilling within 20 meters of any heritage feature;
- No part of any heritage structure may be removed or altered during the construction period without a permit from the South African Heritage Resources Agency (SAHRA); and
- If hidden archaeological and historical finds are exposed during construction work, they should immediately be reported to the authorities, so that an investigation and evaluation of the finds can be made.

Under no circumstances shall archaeological or paleontological artefacts be removed, destroyed or interfered with by anyone on the site. Emang Mmogo (Pty) Ltd shall advise their workers of the penalties associated with the unlawful removal of cultural, historical, archaeological or paleontological artefacts, as set out in the National Heritage Resources Act (Act 25 of 1999), Section 51(1).

6.8 SOCIO ECONOMIC IMPACTS

6.8.1. Impacts on socio-economic environment

Table 25: Impact on employment

Activity	**Job creation**		
Nature of the impact	**Labour required for development (during construction and operational phases)**	Status	-
Receiving environment	• **Residents of the region** • **Developers**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**REGIONAL**	
	Intensity (low; medium; high)	**HIGH POSITIVE**	
	Duration (short; short-med; medium; long; permanent)	**MEDIUM TO LONG TERM**	

	Probability (Improbable; possible; likely; highly likely; definite)		**DEFINITE**
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**HIGH**
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**HIGH**
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(5 + 5+ 5+ 5) x 5 = 100* *High Positive*	
	With mitigation (WM)	*WOM x ME = WM* *100 x 0.2 =20* *High Positive*	
Significance With Mitigation (WM)	**HIGH POSITIVE**		

Source of the impact

Creation of job opportunities during construction and operation for residents of the region.

Description of the impact

The construction phase of the development will provide numerous job opportunities to the skilled professionals, less skilled trades (such as boiler making fitter and turning, drillers, rock blasters etc.) as well as the unskilled and semi-skilled workers residing in the region.

During the operational phase of the development job opportunities will take on a more permanent nature in the form of heavy vehicle drivers, operators, maintenance staff etc.

Significance

The impact can 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 operation of the proposed open cast Manganese and Iron 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.

Mitigation

- If and where possible, the local community should be consulted when sourcing semi-skilled labour.

7. CUMULATIVE IMPACTS

Cumulative impacts as illustrated below, occur as a result from the combined effect of incremental changes caused by other activities together with the particular project. In other words, several developments with insignificant impacts individually may, when viewed together, have a significant cumulative adverse impact on the environment.

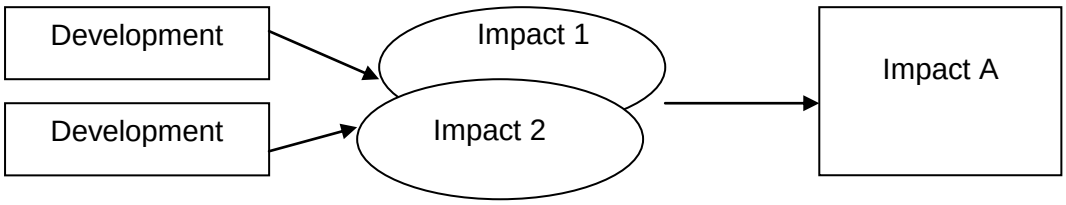

Figure 18: The identification of cumulative impacts

The following cumulative impacts have been identified in terms of the proposed development:

- Cumulative impacts on traffic as a result of more heavy vehicles making use of the roads in the immediate area;
- Cumulative impact on air quality as a result of the open cast mining operations as well as activities associated with this; and
- Cumulative impacts on the decreased quality of the water sources in the area as a result of contaminants being released into water sources.

7.1 CUMULATIVE IMPACT OF AN INCREASE ON THE TRAFFIC

Table 26: Cumulative impact: increased traffic volumes within the mine and surrounding communities

Activity	**Increased volumes of vehicular traffic**		
Nature of the impact	**Congestion on local roads emanating from increased traffic volumes**	Status	-
Receiving environment	**Surrounding communities**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**SITE**	
	Intensity (low; medium; high)	**HIGH**	

	Duration (short; short-med; medium; long; permanent)		**SHORT - MEDIUM**
	Probability (Improbable; possible; likely; highly likely; definite)		**LIKELY**
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*		**LOW MEDIUM**
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*		**HIGH**
Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(2 + 5+ 2+ 3) x 2 = 24* *Low to medium*	
	With mitigation (WM)	*WOM x ME = WM* *24 x 0.2 =4.8* *Low*	
Significance With Mitigation (WM)	**LOW**		

Source of impact:

Traffic will increase in and around the proposed development. The increase of especially heavy vehicles movements surrounding the Emang Mmogo (Pty) Ltd project, such on National and 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 itself 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 within the mine and just outside the boundary of the mine. The cumulative impacts emanating from the increase in traffic may become apparent during the construction phase of the Emang Mmogo open cast mine. The new internalised private mine road could significantly impact on the surrounding communities as long as it is unsurfaced. Temporary access roads could also contribute significantly 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 medium for as long as the internal road 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;
- 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.

7.2 CUMULATIVE IMPACT ON AIR QUALITY

Table 27: Cumulative impact of dust generation

Activity	**Cumulative impact of dust generation**		
Nature of the impact	**Generation of dust caused by drilling and blasting; loading and hauling, loading bins; trucks for hauling and dust dispersion by winds.**	Status	-
Receiving environment	**Surrounding communities**		
Magnitude	*Extent (footprint; site; regional; national; international)*	**REGIONAL**	
	Intensity (low; medium; high)	**MEDIUM**	
	Duration (short; short-med; medium; long; permanent)	**LONG TERM**	
	Probability (Improbable; possible; likely; highly likely; definite)	**HIGHLY LIKELY**	
Weighting factor (WF)	*WF (low; low-medium; medium; medium-high; high)*	**MEDIUM**	
Mitigation Efficiency (ME)	*ME (high; medium-high; medium; low-medium; low)*	**LOW TO MEDIUM**	

Significance	*Without mitigation (WOM)*	*(Extent + Intensity + Duration + Probability) x Weighting Factor* *(3 + 3+ 4+ 4) x 3 = 42* *Medium*
	With mitigation (WM)	*WOM x ME = WM* *42 x 0.8 =33.6* *Low to medium*
Significance With Mitigation (WM)	**LOW TO MEDIUM**	

Source of impact:

- 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:

Dispersion simulations should be executed for the proposed operational phase. Previous experience with Manganese and Iron open cast mines indicated that PM10 and TSP should be assessed. The predicted concentrations for these pollutants are discussed below. In order to account for cumulative impacts, measured PM10 concentrations from the mines surrounding the Middelburg community should be used. The annual average concentration of 52µg/m^3 is used to reflect the background concentrations at the Emang Mmogo open cast Manganese and Iron mine.

PM10

The predicted mitigated daily average ground level concentrations for the proposed operations at the Emang Mmogo (Pty) Ltd facility do not exceed the daily current South African standard of 180µg/m^3 or the proposed South African standard of 75µg/m^3 at the mine boundary or the sensitive receptor sites.

Due to the elevated PM10 background concentrations, however, the predicted cumulative concentrations exceed the proposed South African standard at the mine boundary and at all the sensitive receptor sites as depicted in Table 20 as the values in brackets.

The predicted annual average ground level concentrations for the proposed Emang Mmogo (Pty) Ltd operations do not exceed the current annual South African standards of 60µg/m^3 and the proposed South African standard of 40µg/m^3 outside the mine boundary. Since the background PM10 concentration of 52µg/m^3 already exceeds the proposed South African standards, cumulative predictions also exceeds. It is however noted that the Emang Mmogo (Pty) Ltd activities are a small contribution to the cumulative concentrations.

Significance of the impact:

The cumulative impact of PM10 concentrations has a significance of Medium.

Mitigation:

- It is recommended that an Air Pollution Control System (APCS) be developed for the Emang Mmogo (Pty) Ltd activities to reduce and control all main contributing sources. This APCS includes detailed management plans, mitigation measures and monitoring and operational procedures developed for each significant source of emission to ensure emissions reduction will occur. The APCS must be implemented and revised by mine personnel on an ongoing basis. This APCS can be incorporated into the Environmental Management System (EMS) of the mine.
- The absence of visible dust plume at all tipping points and outside the primary crusher would be the best indicator of effective control equipment in place. In addition the dust fall in the immediate vicinity of various sources should be less than 1200mg/m^2/day. From all activities associated with the Emang Mmogo (Pty) Ltd mine; dust fall levels should not exceed 600mg/m^2/day.
- Additional mitigation measures are included in the EMP.

8. CONCLUSION

The Scoping phase of the EIA process was aimed at establishing the scope of the proposed development as well as its key issues and potential impacts on the surrounding environment. The evaluation of the project motivation, the status quo of the social and natural environment, as well as the inputs received from Interested and Affected Parties during the Scoping Process, highlighted the following needs and concerns:

- The need to undertake mining activities bearing in mind the potential impacts the activity may have on adjacent landowners;
- The need for assessing water source alternatives so as to not strain already strained water resources in the area; and
- Concerns related to the cumulative impacts of the proposed development on the air quality and traffic congestion on the internal roads as well as the surrounding communities.

From this, the need for particular specialists' studies was determined. Specialists' studies assisted with the development of an understanding of the system processes and the potential impacts of the proposed development on both the social and biophysical environments. The following specialists' studies were undertaken as part of the Scoping phase:

- Riparian Delineation and Functional Assessment;
- Ecological Assessment;

Key issues identified for the assessment during the EIA phase of the Emang Mmogo (Pty) Ltd project include:

Water Resources:

- Increase in watercourse sedimentation, erosion and general pollution of surface water resources; and
- The quantity of groundwater resources:
    - Depletion of the underground aquifer; and

- Pollution of groundwater resources due to seepage from open cast Manganese and Iron mining activities.

Air Quality:

- Dust levels and related health impacts from the generation of dust.

Destruction of Sensitive Flora and Fauna:

- The ecological *status quo* of the Emang Mmogo area;
- Riparian areas on site and in the surrounding area;
- The dispersal of existing flora and fauna on site by means of existing water channels; and
- Spill-over impacts, which may occur on adjacent ecological systems.

Soils and Land-use Capability:

- Loss of soil resources for agricultural land uses;
- Soil degradation as a result of mining activities; and
- The utilization of soil resources for inappropriate land uses backfilling cut areas.

Noise vibration and shock:

- Increase in the ambient noise level as a result of blasting activities,
- The disruption of current ambient noise levels; and
- The disruption of sensitive receptors by means of increased noise and vibration.

Socio-economic:

- The determination of the extent to which the current social *status quo* will be altered and if so, the manner in which such changes will occur.

Visual Impact:

- The visual character of the area as a result of the establishment of mining infrastructure such as a Manganese and Iron ore dump.

Traffic:

- The change in the traffic patterns as a result of traffic entering and exiting the Emang Mmogo open cast Manganese and Iron mine on the surrounding road infrastructure and existing traffic.

Job Creation:

- 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.

The cumulative impacts have been identified in terms of the proposed development:

- The cumulative impacts of traffic; and
- The cumulative impacts of air quality.

These key impacts, together with the potential cumulative impacts were assessed during the impact assessment phase of the project in order to predict the nature and characteristics of the impacts and establish appropriate mitigation measures to reduce the identified impacts as far as possible. The summary of the significance of identified impacts before and after mitigation is given in the table below:

Table 28: Summary of the impact significance

Environmental aspect	Significance WOM	Significance WM
Impacts on groundwater levels	Low to Medium	Low to Medium
Impacts on groundwater levels due to the dewatering of the open pit	Medium	Medium
Contamination of surface and groundwater resources due to the migration of contaminated water from the mining operations	Medium	Medium
Pollution of surface water due to construction and operation activities	Low	Low

Destruction of Riparian Habitat	Medium to High	Medium
Altered Hydrological Regime	Medium to High	Medium
Atmospheric pollution	Low to Medium	Low
Impacts on Rare and Endangered Fauna and Flora	Low to Medium	Low
Destruction of Natural Habitat	Low to Medium	Low
Reduction of Natural Migratory Routes	Low to Medium	Low
Noise and Vibration	Low to Medium	Low
Visual impacts	Medium	Medium
Soil Erosion and Surface runoff	Low	Low
Soil Pollution	Low	Low
Heritage resources	Low to Medium	Low
Socio-economic environment – job creation	High Positive	High Positive

8.1 ASSUMPTIONS AND LIMITATIONS

- All information provided to the environmental team by the applicant and I&APs was correct and valid at the time that it has been provided;
- The investigations undertaken by specialists during the EIA process, indicated that the development site is suitable and technically acceptable;
- It is not always possible to involve all I&APs individually, however every effort has been made to involve as many affected stakeholders as possible;
- The information provided by the applicant and specialists was accurate and unbiased; and
- The scope of this investigation is limited to assessing the environmental impacts associated with the construction, operation and decommissioning of the proposed mine.

8.2 RECOMMENDATIONS AND REASONED OPINION OF THE EAP

Based on the findings of the EIA, the EAP is of the opinion that the proposed development be approved based on the extensive positive impacts it will have on the local and regional communities. These positive impacts include among others industry specific and general skills development programmes for the local community. This will result in social upliftment

and will have a cumulative effect on the economy and social conditions of the population in the area.

The potential negative impacts can be mitigated to acceptable levels and therefore are not a limiting factor in the approval of the environmental authorisation.

With regards to the status quo of the sites local environment and information made available to the consultants, the proposed development will not result in any fatal flaws in terms of the environment that should prevent the development from proceeding. Provided that the correct mitigation measures are implemented in accordance with the EMP, impacts that would potentially have a significant negative effect on the environment will be minimised to medium and low impacts.

All recommendations of the specialists' studies should be adhered to and incorporated into a detailed Environmental Management Plan (EMP). It is specifically recommended that:

- The groundwater system and ground and surface water quality, is monitored and models and assessments updated as more information becomes available;
- Rehabilitation and monitoring plan should be developed to ensure the success of Riparian re-establishment. Furthermore, every effort should be made to prevent the impact on the remaining Riparian on the study site;
- Blasting vibrations should be controlled by means of optimizing blast hole geometry and altering the time of blasting;
- Implementation of a dust and noxious gases minimization strategy that will reduce the impact of atmospheric pollution be undertaken. This strategy will include the use of noxious gas fixation techniques, using and adhering to blasting schedules, and strategies that minimize dust generation;
- The building textures and colors should blend in with the backdrop of color and textures provided by the landscape. The natural setting and colors of buffs, olive greens, dark browns should be respected and where possible, these should be incorporated into the materials used in the exteriors of the building and landscape;
- Colors of new infrastructure should be matt and not glossy, so as to reduce reflection and glare from the surfaces. This is important when considering the night scene and reflected light;

- Disturbed surfaces must be ripped, and the area must be backfilled with topsoil or overburden and appropriately re-vegetated when rehabilitation commences;
- The topsoil layer must be retained and used in facilitating the reinstatement of indigenous vegetation;
- By maintaining the maximum amount of vegetated area on site, the extent of erosion and ecosystem loss can be contained;
- An ecologically-sensitive storm water management plan should be implemented during the construction phase;
- Dust fallout monitoring should be carried out close to the sensitive receptors around the mine area and in the proposed site for the operational activities. It is recommended that dust deposition monitoring be confined to sites within, and in close proximity (<2 km) to the proposed mine operations. Monitoring should be undertaken using the American Society for Testing and Materials standard test method; for the collection and analysis of dust fall (ASTM D-1739) or any other method which can demonstrated to give equivalent results (SANS, 2004). Dust fallout at the sensitive receptor sites should be below 600 mg/m²/day at all times;
- No blasting with explosives or heavy drilling within 20 meters of any heritage feature may occur;
- It is recommended that an existing community based organisation and non-government organisation in the surrounding area be used to serve as a communication channel between the community and Emang Mmogo(Pty) Ltd ; and
- Labour guidelines should be drafted in terms of employing local residents as it is expected that there will be an influx of newcomers in search of employment.

The mitigation measures suggested by the specialists in their reports include:

Riparian zones and river systems are protected under the National Water Act 1998 [Act 36 of 1998] and therefore, considering best practice, are to be buffered by 100m (from the temporary zone) outside of the urban edge.

The Public Participation Process (PPP) has been duly undertaken as per the requirements of the NEMA Act 107 of 2008 and the issues of I&APs have been adequately addressed.

It is recommended that the conditions set out as part of the authorisation are adhered to. A dedicated and suitably experienced ECO needs to be appointed to monitor compliance of the EMP. It is anticipated that construction will start as soon as possible after the environmental approval and all the necessary approvals are obtained prior to construction.

It can be concluded that the proposed development will not conflict with the principles of the National Environmental Management Act, 1998 (Act No 107 of 1998) [NEMA] and the Minerals and Petroleum Resources Act, 2002 (Act No 28 of 2002) [MPRDA] and should, therefore be authorised. The Public Participation Process (PPP) has been duly undertaken as per the NEMA and the issues raised by the I&APs have been adequately addressed. It is therefore recommended that the proposed development should proceed subject to the implementation and enforcement of the recommendations and mitigation measures contained in this EIA Report and EMP.

9. ENVIRONMENTAL MANAGEMENT PROGRAMME

9.1 ENVIRONMENTAL POLICY STATEMENT

9.1.1. Vision

"Emang Mmogo (Pty) Ltd's vision as a primary producer of Manganese and Iron is to create value by discovery, development and marketing of minerals and metals. To respect communities and nations that hosts our operations and conduct business in a sustainable socially and environmentally responsible way."

9.1.2. Commitment

In order to meet this vision and our value of Zero harm, Emang Mmogo (Pty) Ltd is committed to:

- Implementing and maintaining effective safety, health and environmental management systems that drive continual improvement through regular, objective review;
- Ensuring employee knowledge of the safety, health and environmental risks by effective assessment and training;
- The reduction, re-use and recycling of waste to minimise final disposal and promote the efficient use of natural resources;
- Preventing and reducing all forms of pollution by employing effective technologies to control emissions to air and pollution of land and water;
- Maintaining transparent, consultative relationships with all stakeholders through effective communication channels;
- Contributing to the long-term social, economic and institutional development of our employees and the communities within which our operations are located;
- Complying with acceptable legislation and other relevant industry norms;
- The identification, assessment and management of risks to employees, contractors, the environment and communities in which we operate;
- Making adequate financial provision during the expected life of our operations to ensure sustainable life when operations cease;

- Supporting the fundamental human rights of employees, contractors and the communities in which we operate; and
- Respecting the traditional rights of indigenous people.

9.1.3. Emang Mmogo (Pty) Ltd Objectives

Are to:

- Promote equitable access to the nation's mineral resources to all the people of South Africa;
- Substantially and meaningfully expand opportunities for HDSA's including women, to enter the mining and minerals industry and to benefit from the exploitation of the nation's mineral resources;
- Utilise the existing skills base for the empowerment of HDSA's;
- Expand the skills base of HDSA's in order to serve the community;
- Promote employment and advance the social and economic welfare of mining communities and the major labour sending areas; and
- Promote beneficiation of South Africa's mineral commodities.
- Be proactive in the area of HIV/AIDS, through the provision of HIV/AIDS awareness education. The programme is to educate the workers in HIV/AIDS and to dispel the myths surrounding the pandemic; and
- Emang Mmogo intends to contribute to the development of small miners through mentoring, workshops, technical, finance, advice, etc.

Safety:

The management of Emang Mmogo Resources is committed to an active Health and Safety Programme and will continue to provide leadership and support to achieve and maintain the highest standards. Management undertakes to regard the safety and health of its employees, customers and the general public as highest priority.

This requires the safety and health function to be completely integrated in management practices and principles and therefore forms part of the daily management activities and responsibilities.

The health and safety of everyone exposed to our operations, whether in the workplace or in our environment, is of primary importance to management. In conjunction with our employees, the company will do everything in its power to prevent accidents, injuries, occupational illness or release of materials, which could be detrimental to the environment.

Management accept their responsibility to inform those who may be exposed to known hazards and to develop appropriate operating standards as part of an effective prevention programme.

The company believes that achievements in safeguarding the workplace and our environment against hazards resulting from our operations are valued equally with other results. Quality Improved Process reinforces our performance on matters of safety, occupational health and the environment.

Emang Mmogo Resources' Health and Safety Management system will aim at:

- Preventing injury and rendering an effective first aid service;
- Reducing economic losses;
- Reducing property damage;
- Eliminating losses due to fires, explosions and unplanned interruption to operations;
- Ensure that all our employees receive proper training; and
- Meeting our social responsibilities.

Emang Mmogo Resources, in partnership with all spheres of government, undertakes to:

- Co-operate in the formulation of integrated development plans for communities where mining takes place and for major labour-sending areas, with special emphasis on development of infrastructure.
- Emang Mmogo Resources plays a vital role in the development of communities through social plans with a view to job creation, provision of education and skills upliftment as well as the development of healthcare facilities, transport, water, sanitation, waste, spatial development, people development.
- The creation of a sustainable mining environment through the following model:
    - Investing in Integrated Development Programmes (IDP);
    - Establishing scholarship programs and bursary funds;
    - Establishing mentorship programmes for SME'S;
    - Creating Community Trusts to achieve sustainability;
    - Social and labour plans (**Error! Reference source not found.**);
    - Training and skills upliftment programs; and
    - HIV Programs.

Environmental Sustainability

Emang Mmogo Resources is proactive in the field of Environmental Sustainability in all our investments through Environmental Management Programme and rehabilitation funds. Emang Mmogo will not compromise in its endeavours to achieve the highest standards in the management of the environment, and health and safety and will:

- Conduct responsible mining practices;
- Ensure high standards of safety at all operations;
- Ensure adequate closure and rehabilitation provisions are in place; and
- Create HIV/AIDS and general health care awareness.

9.2 ENVIRONMENTAL POLICY STATEMENT

9.2.1. Closure Objectives

The goal upon decommissioning and closing of the Emang Mmogo (Pty) Ltd mine at Emang Mmogo will be negotiated between Emang Mmogo (Pty) Ltd, the state departments and the Interested and Affected Parties. This will further include that all significant impacts have been mitigated and that there are no alterations to the environment that are apparent as far as is practically possible. All land will be rehabilitated to a state that facilitates compliance with current national environmental quality objectives including air quality objectives and water quality guidelines.

It should be noted that upon closure all disturbed areas will be rehabilitated, and the land will be returned to its original land use.

The following Environmental management Programme (EMP) has been structured in such a manner as to provide a basis for an Environmental Management Systems (EMS) for the life of the proposed development. It should further be noted that the proposed EMP is not static, as allowances have been made for it to evolve through the life of the project. Such a characteristic is seen to be important as key factors and processes may change through the life of the project. It is therefore necessary to alter proposed mitigation and monitoring methodologies in order to determine the best approach to deal with such changes.

Specific attention has been made to ensure that the EMP conforms to the following criteria:

It is auditable in that it:

- Identifies specific quantifiable monitoring regimes;
- Delineates key lines of accountability;
- Where practically possible identifies key indicators, which can be utilised for environmental performance monitoring;
- Ensure flexibility to enable the incorporation of additional monitoring and mitigation techniques as deemed necessary throughout the life of the mine;
- Confirm to the best practice principles by acknowledging (through its strong relationship with the EIA – Section 6 and 7) the existence of both long-term and

immediate impacts and the resulting mitigation measures necessary to deal with such;

- Identifies key corporate commitments, made by Emang Mmogo (Pty) Ltd with regard to its environmental performance.

9.3 ROLES AND RESPONSIBILITIES

9.3.1. Proponent

The proponent remains ultimately responsible for ensuring that the development is implemented according to the requirements for the EMP. Although the proponent appoints specific role players to perform functions on their behalf, the responsibility is up to the role players to ensure compliance with the EMP. The proponent is ultimately responsible for ensuring that sufficient resources (time, financial, capacity, equipment) are available to the role players (e.g. the Safety Health Environmental and Quality Department (SHEQ)) to efficiently perform their tasks in terms of the EMP.

9.3.2. Contractors

The contractors as the proponent's implementing agent on site, are bound to the conditions as stipulated in the EMP through contractual agreements and are therefore responsible for ensuring that they adhere to all the conditions for the EMP. The contractors must thoroughly familiarise themselves with the EMP requirements prior to commencing with work on site. Furthermore, the contractors must request clarification on any aspect of the EMP, where required. The contractors must ensure that all workers undergo an environmental induction in terms of the EMP. The contractors must ensure that they provide sufficient budget for complying with all the EMP conditions in the tender stage.

9.3.3. Safety, Health Environment and Quality (SHEQ)

The Emang Mmogo Mining (Pty) Ltd SHEQ department will be responsible to address the environmental aspects of the Emang Mmogo open cast Manganese and Iron mine.

9.3.4. Environmental Control Officer (ECO)

An ECO is an independent appointment who objectively monitors implementation of the relevant environmental legislation, conditions of the Environmental Authorisation (EA), and the EMP of the project. The ECO must be on site prior to any site establishment and must endeavour to form an integral part of the project team.
The ECO must be proactive and have access to specialists expertise as and when required, these include botanist, ecologist etc.

The ECO must conduct audits on compliance to relevant environmental legislation conditions of the EA and the EMP for the project. The size and sensitivity of the development, based on the EIA, will determine the frequency at which the ECO will be required to conduct audits.

The ECO must be the liaison between the relevant authorities and the project team. The ECO must communicate and inform the developer and consulting engineers of any changes to the environmental conditions as required by the relevant authority bodies. The ECO must ensure that the registration and updating of all relevant EMP documentation is carried out.

The ECO must be suitably experienced with the relevant environmental management qualifications and preferably competent in construction related methods and practices.

The ECO must handle information received from whistle blowers as confidential and must address and report these incidences to the relevant Authority as soon as possible.

A fulltime ECO will be appointed during the construction phase. Once operation of the plant commences, the responsibilities of the ECO will be transferred to the SHEQ Department. The ECO employed during the construction phase must attend relevant project meetings, conduct inspections to access compliance with the EMP and be responsible for providing feedback on potential environmental problems associated with the development. In addition the ECO is responsible for:

- Liaison with relevant authorities;
- Liaison with contractors regarding environmental management; and
- Undertaking routine monitoring.

The ECO has the right to enter the site and undertake monitoring and auditing at any time, subject to compliance with all environmental requirements applicable to the site.

9.4 CONSTRUCTION PHASE

Table 21 below contains a list of potential environmental issues and the appropriate mitigation measures that may be associated with the construction phase of the Emang Mmogo open cast Manganese and Iron mine. This section serves as a framework for the construction contractor within which to execute his contractual duties. The detailed EMP may be included to the final contract(s) with the relevant construction contractors.

The table only addresses those impacts that may occur on the site during the construction and associated management measures that may require additional environmental management.

Table 29: Mitigation measures to be implemented during the construction phase of the Emang Mmogo open cast mine

Issue	Mitigation
Geology	
Target: To ensure that optimal use is made of the available mineral resources.	
Loss of geological resource	Construction should not limit the potential to exploit deeper resources.
Topography	
Target: To ensure that the topography is not significantly altered during the construction phase.	
General land disturbance	Limit all activities to be proposed mine footprint area.
Soils	
Target: Soil degradation through mining activities to be managed to ensure that effective rehabilitation measures are in place.	
Loss of topsoil	Topsoil must be deemed to be the top layer of soil containing organic material, nutrients and plant seeds. For this reason it is an extremely valuable resource for the rehabilitation and vegetation of disturbed areas.
	Avoid undue storm water concentration. Construct runoff measures according to soil conservation principles.
	The soil that is excavated during construction should be stock-piled in layers and protected by berms to prevent erosion.
	The stockpiles may only be placed within the demarcated areas the location of which must be approved by the ECO.
	Soils from different horizons must be stock piled such that the topsoil do not get contaminated by sub soil material
	Topsoil stockpiles must be clearly demarcated as no-go areas
Soil erosion	Avoid bare, disturbed surfaces for long periods (e.g. re-vegetate stockpiled topsoil). Erosion in the area is to be curtailed especially if the erosion is being caused as a result of the construction activities.
	Any runnels or erosion channels developing during the construction period or during the operational and maintenance period shall be backfilled and consolidated immediately and the area restored to the proper condition. The Emang Mmogo open cast Manganese and Iron mine shall not allow erosion to

	develop on a large scale before effecting repairs and all erosion damage shall be repaired as soon as possible. Topsoil washed away shall be replaced.
Compaction	Minimise compaction of any topsoil during stockpiling by working the soil in the dry state
	Avoid unnecessary trafficking on any undisturbed areas
	Rip compacted areas affected by the construction to reduce runoff and improve re-vegetation
Dustiness	Dust will be suppressed as necessary by means of a dedicated water cart
	Exposed areas, which were disturbed by construction activities, need to be covered either by vegetation or any other suitable means
Potential loss of soil fertility	Topsoil stockpiles must not exceed 2m in height as this will cause compaction and loss of fertility
Alien plants on topsoil stockpiles	Stockpiles must be monitored for alien vegetation any existing alien vegetation must be removed and destroyed.
Soil contamination	The concrete batching site (if required) will be appropriately rehabilitated
	A “hazardous materials spillage contingency plan” should be in placed
Erosion due to Storm water runoff	Emang Mmogo (Pty) Ltd shall take measures, to the approval of the Environmental Control Officer (ECO) to ensure that there is no undue Storm water damage and soil erosion resulting from the construction activities inside and outside the mining area.
	Surface storm water shall, where possible, not be allowed to be concentrated and the flow down cut or fill slopes without protection measures being in place.
	Overflow and / or scour channels shall be lined with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge shall be at a point where there is dense natural grass cover. These channels shall not discharge straight down the contours but shall be aligned at such an angle to the contours that they have the least possible gradient.
	Storm water runoff from the stockpile sites and other related areas must be directed into the storm water system when the necessary pollution prevention measures such as a silt traps and may not run freely into the immediate and surrounding environments.
Vegetation	
Target: To ensure that the required removal of flora is limited to the footprint and the mitigated against as far as possible	
• Disturbance to flora; • Loss of medicinal and or	Access roads may be kept to a minimum, and where possible existing tracks should be used.
	Construction vehicles should remain only in the area to be disturbed by the road and other works at all times. Disturbance should be restricted to the actual project area.

protected species	The areas disturbed by the placement of spoil material are to be monitored and kept to a minimum.
	Power line pylons should, as far as possible, not be placed in areas where erosion has already occurred or is likely to occur as this may exacerbate the problem.
	Access roads should be kept to a minimum, and where possible existing tracks should be used.
	New access roads should be aligned so as to remain on the flattest terrain possible for as long as possible.
Spread of alien plant species	Materials such as sand and stone should, wherever possible, be sourced from areas which are free of alien plants.
	Should alien species be identified then these should immediately be removed.
Disturbance to Riparian areas	The alien trees present within the proposed mining area should ideally also be removed to enhance the existing Riparian functions.
	Roads should not be constructed in Riparian area, rivers and streams or dry watercourses or within the 1:100 years flood line of any of these unless no other alternative can be found. Where roads must be constructed through these areas, sufficient culverts should be provided to allow water to flow through. Additionally the client should undergo a Water Use License Application (WULA) Section 21 i.
	Where a road runs adjacent to a Riparian and impede natural runoff from a hill slope, the road should be separated by an appropriate buffer from the Riparian boundary. Feed-off points should be incorporated into the road at regular intervals (at least every 100m)
	The use of herbicides should be limited as far as possible. Herbicides should only be used under strict control and only when no other option is available. Herbicides should not be used near sensitive environments especially Riparian areas.
	Power line pylons should preferably not occur in Riparian areas, rivers and streams or dry watercourses or within the 1:100 years flood line of any of these.
	Storm water mitigation measures, such as Storm water retention dams, should be constructed outside the buffered Riparian areas, where they can intercept storm flows, store the water for approximately 48 hours, and release it slowly into the Riparian.
	Storm water outflows should not be allowed to enter directly into a Riparian, but must be well buffered by vegetation and accompanied by energy dissipating interventions to prevent erosion.
Rehabilitation of construction camps	The contractor must rehabilitate the construction camp and any other disturbed areas once construction activities have terminated. Compacted areas will be ripped and mulched in order to ensure recovery of natural vegetation cover. A method statement must be provided and maintained by the contractor.
Animal Life	
Target: To ensure that the required removal of fauna is limited to the footprint and the mitigated against as far as possible	
Faunal displacement and	The construction activities will be limited to the proposed mine footprint area.

loss of habitat	All activities on site must comply with the regulations of the Animal Protection Act, 1962 (Act No 71 of 1962).
	Environmental induction training and awareness must include aspects dealing in safety with wild animals onto site. Focus on animals such as snakes and other reptiles that often generate fear by telling staff how to move safely away and to whom to report the sighting. Workers should also be informed where snakes most often hide so that they can be vigilant when lifting stones etc.
Poaching	All construction workers must be informed that the intentional killing of any animal is not permitted as faunal species are a benefit to the society. Poaching is illegal and it must be a condition of employment that any employee caught poaching will be dismissed. Employees must be trained on how to deal with fauna species as intentional killing will not be tolerated. In case of a problem animal e.g. a large snake a specialist must b called in to safely relocate the animal if the EO or ECO is not available.
Pests	Emang Mmogo Mining (Pty) Ltd shall ensure that the work site is kept clean and tide and free from rubbish, which would attract animal pest species.
Loss of protected species	Emang Mmogo(Pty) Ltd supervisory personnel shall be given a basic training in the identification of species of high conservation value.
Surface water	
Target: To ensure that mining activities do not negatively impact on the aquatic systems by implementing management programmes to effectively monitor water quality, water management practices and mitigating measures	
General	Before any work is carried out in an area of the site, all specified or directed or approved pollution control measures shall be in place and operational.
	Limit movement of vehicles and equipment
	All diverted and pumped water shall be discharged at locations on the surface from which it cannot re-enter the works and in a manner which does not cause erosion
Pollution of surface water	Before any work is carried out in any area of the site all specified or directed or approval pollution control measures shall be in place and operational.
	Encourage and teach workers not to litter.
	Under no circumstances may ablutions occur outside the p[provided facilities.
	Storm water management will be implemented to ensure that polluted and clean water will be separated and to reduce the velocity of the Storm water.
	Create diversion channels to ensure that no clean water flows across the site during construction.
	Waste oil or other hydrocarbons from workshops and other areas must be disposed of by a registered waste disposal company.
Disturbance of Riparian	Plan construction to avoid any impact on the natural drainage of the site and Riparian functionality

areas	Provide permeable surfaces to address increased runoff volumes at source and allow infiltration of the runoff.
	Implement and ecologically sensitive Storm water management plan that includes not allowing Storm water to be discharged directly into the identified buffer zone of the watercourse and drainage.
	Ensure that the following control measures are in place to prevent oil, grease, fuel or chemicals from reaching a water resource: • The fuel supplier shall provide and maintain bud walls around his fuel storage facility within the site. Such walls shall be of a sufficient height to contain 110% of the entire contents of his fuel storage facility. • Soil contamination by oil, fuel or chemical leakage shall either be removed and placed in disposal areas as directed by the Emang Mmogo resources Environmental Centre or shall be rehabilitated *in situ*. • All relevant staff are to be trained on waste management and petro-chemical spill ISO 14 001 procedures according to the training matrix; • All spillages of oil onto concrete surfaces shall be controlled by the use of an approved absorbent material; • All old oil shall be retained for re-use/recycling by the supplier / recycling company; • Concrete shall be mixed only in areas, which have been specifically demarcated for this purpose. All concrete that is spilled outside these areas, shall be promptly removed and taken to an approved landfill site. After all concrete mixing is complete, all waste concrete shall be removed from the batching area and disposed of at an approved landfill site. Storm water shall not be allowed to flow through the batching area; and • Disposal of waste oil or other chemicals from workshops and other areas shall not cause pollution of rivers, streams or soil.
Mixing of concrete	Concrete must be mixed on mixing trays or plastic liners. If mixing of concrete is to take place on exposed soil, this has to be demarcated areas that must be bunded. This is so that the cement is not washed away during heavy rainfall events.
	Concrete and tar shall be mixed in specifically demarked areas only.
	All concrete and tar that is spilled outside these areas shall be promptly removed by the contractor and disposed of at a registered landfill site.
Sedimentation of water resources	To prevent erosion of material that is stockpiled for long periods, the material must be retained in a bermed area.
	All construction areas should be suitably rehabilitated and re-vegetated as soon as possible after construction.
	Ensure that surface water does not artificially recharge ground water.
	All surface runoff shall be collected in side drains on the upslope shoulder of the entrance road. These drains shall be stoned pitched to prevent erosion.
	Storm water deflection berms or stone pitched channels shall be constructed at regular intervals (plus minus 30 – 60m) diagonally across new roads on slopes

	as directed by the Environmental Control Officer
	Control over surface runoff by: • Construction of stabilised diversions or perimeter cut-off drains to intercept run-off from undisturbed areas and to divert run-off around the works; • Installation of stabilised inceptor drains which run across the site along contour; • Installation of stabilised collector drains which run down the slope perpendicular to the contours; • Construction of sedimentation retention ponds; • Construction of gabion weir structures.
	Fuel storage and machinery maintenance: • Emang Mmogo (Pty) Ltd shall provide and maintain bund walls around the fuel storage areas within the site. Such walls shall be sufficient height to contain 110% of the entire contents of his fuel storage facilities. This shall apply to storage above ground. The Emang Mmogo(Pty) Ltd shall prepare and submit plans and details of such bund walls to the Environmental Control Officer at least 30 days before commencing work on the site; • Drainage from fuel storage and machinery maintenance areas shall be treated to remove oil and / or fuel. Where the drain passes through or across the bund wall, a means of preventing flow will be provided so that in the event of a leak all spilt fuel and other liquids will be contained by the bund walls; • Soil contaminated by oil, fuel or chemical leakages shall be removed and placed in disposal areas as directed by the Environmental Control Officer; • Education on the proper methods for cleaning workshops and fuel points to prevent fuel and oil being washed out of containment areas will take place; • Waste runoff water from the vehicle wash bay, workshop and diesel / fuel tank area shall be collected in a series of converted conservancy tanks to firstly settle silt and secondly to remove oil. The oil sludge thus collected shall be disposed of at an approved toxic waste disposal site. Water from the conservancy tanks shall be drained to retention areas; • Above mentioned areas should be dished concrete floor slabs which drain into the conservancy tanks; • All spillages of oil onto concrete surfaces shall be controlled by the use of an approved absorbent material such as Ociansorb or Drizit; • All old oils shall be retained for re-use by the supplier
Ground water	

Target: To ensure that mining activities do not negatively impact on the Ground water systems, by implementing management programs to effectively monitor water quality, water management practices and mitigating measures.	
Pollution of underground water resources	Separate clean and dirty water systems;
	Seal shallow ground water influxes into mine workings;
	Provide sufficient storage capacity for contaminated runoff and process waters;
	Construct suitable facilities to prevent seepage/infiltration and to contain;
Ground water Level impact - dewatering	A Ground water and surface water monitoring programme should be planned and implemented prior to the commencement of mining.
	Monitoring boreholes should be established as soon as infrastructure design is completed and approved.
	Monitoring boreholes should be constructed and sited according to DWAF standards and guidelines.
	Water level and quality monitoring should commence when the construction of the box cut commences.
Air Quality	
Target: To ensure that the impact caused by construction activities regarding air pollution is managed by employing sound management principles based on best practical environmental options that complies with legal and other requirements.	
PM 10 concentrations and dust fallout	Suitable wet suppression techniques must be utilised on all exposed areas: • Wet suppression or chemical stabilization of unpaved roads; • Reduction of mud/dirt carry-out onto paved roads; • Reduction of unnecessary traffic; • Strict speed controls are to be enforced; and • Ensure that all vehicles travelling with materials during the construction phase are fitted with tarpaulins.
Dust/Air pollution	• Phasing of earthmoving activities shall be undertaken, to reduce source size; • Early paving of permanent roads; • The extent of open areas needs to be kept to a minimum; • Reduction of frequency of disturbance;

	• Early re-vegetation; and • Compaction and stabilization (chemical or vegetative) of disturbed soil shall occur.
Health impacts of dust	Personal protective equipment in the form of dust masks must be provided to employees if the working conditions require protection from dust.
Emissions from vehicles	Vehicles and machinery must be serviced regularly to ensure that vehicle emissions are kept to a minimum.
General	The burning of any of waste or plastic material must be prohibited.
Blasting	Implement a dust and noxious gases minimization strategy that will reduce the impact of atmospheric pollution. This will include the use of noxious gas fixation techniques, using and adhering to blasting schedules, and strategies that minimize dust generation.
Noise	
Target: Ensure that the impact caused by the disruption of ambient noise levels and or increase in continuous noise levels are assessed and recorded and complies to the relevant legal requirements governing noise pollution	
Blasting vibrations	Affected communities must be notified when blasting is scheduled to take place.
Noise from construction activities	Workers must be issued with the necessary protective equipment, including ear plugs, when working in conditions that may progressively have detrimental affects on their health.
	All complaints and/or non compliances will be investigated by the responsible environmental officer and the necessary actions will be taken.
	Environmental noise monitoring should be carried out at regularly to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted.
	Ensure that all machinery and vehicles are well maintained and road worthy.
	Noise at equipment and machinery point sources should be damped through acoustic treatment and applying silencing equipment.
	Workers must be issued with the necessary protective equipment, including ear plugs, when working in conditions that may progressively have detrimental affects on their health.
Sites of Archaeological and Cultural Interest	
Target: Ensure that all cultural and heritage sites are protected from degradation and deterioration	
Disruption of sites with	If archaeological sites are exposed during construction work, it should immediately be reported to a museum, preferably one at which an archaeologist is

archaeological and/or cultural interest	available, so that an investigation and evaluation of the finds can be made.
	Under no circumstances shall archaeological artefacts be removed, destroyed or interfered.
Visual Aspects	
Target: To ensure that extensive scaring of the landscape does not take place as a result of construction	
Scarring of the environment	Areas where vegetation and or topsoil has been stripped to establish facilities that will be removed with the completion of the construction phase must be restored to the pre-disturbance state, by clearing waste, spreading topsoil and re-establishing vegetation cover.
Construction activities	The Emang Mmogo(Pty) Ltd shall not establish or undertake any activities, which in the opinion of the Environmental Control Officer, are likely to adversely affect the scenic quality of the area by referring to the activities' texture, scale, locality and appearance. The Environmental Control Officer may direct the Emang Mmogo(Pty) Ltd to refrain from such activities or to take mitigatory actions to reduce the adverse effect of such activities on the scenic quality of the environment;
Design of the plant and associated infrastructure	The colours of all permanent structures shall be chosen so as to blend in with the dominant colours of the surrounding landscape. Painted surfaces shall be painted with non-reflective (matt) colours, preferably with a grey hue.
Socio-Economic Structure	
Target: To ensure that the socio-economic status of the communities are not detrimentally affected by the construction operations	
Inflow and outflow of temporary workers and the pressure on infrastructure	The mine must maintain the existing human resource development plan to enhance the use of local skills and further develop local skills.
	All labour should as far as practically possible be sourced from the local communities.
Traffic	Ensure drivers and operators of equipment are familiar with the safety policies.
	Vehicular traffic on site should be limited within a 80 km/h speed limit.
	Only main roads should be used.
	Where feasible, vehicles should not operate on public roads during peak hours.
	All vehicles entering and leaving the site should be road worthy.
	Integrate the road layout with the attributes of the biophysical, social and economic setting to reduce the extent of change and disturbance to these.

	Communicate with and acknowledge the concerns of the I&AP's and mitigate where possible.
	Maintain effective communication links with the local communities.
Safety Risks and Hazards	Design, implement and enforce an appropriate Safety, Health and Environment (SHE) programme that includes the use of PPE to ensure the well being of staff
	Implement a dust and noxious gases minimization strategy that will reduce the impact of atmospheric pollution. This will include the use of noxious gas fixation techniques, using and adhering to blasting schedules, and strategies that minimize dust generation.
	Emergency preparedness is required for (among other things) spillages of hazardous substances which would impact on animals, plants and Riparian areas. In this regard the Emang Mmogo(Pty) Ltd shall: • carry out a risk analysis for sections where spillage would have the most severe consequence; • develop a strategy and management action plan in collaboration with existing emergency services.

9.5 OPERATIONAL PHASE

Table 30: Mitigation measures to be implemented during the operational phase of the Emang Mmogo open cast mine

Issue	Mitigation
Geology	
Target: To optimise the exploitation of the mineral resource.	
Loss of mineral resource	Ensure that optimal use is made of the available mineral resource.
Topography	
Target: To ensure that the topography is not significantly altered during the Operational Phase.	
General land disturbance	Limit all activities to the proposed mine footprint area.

	The Emang Mmogo(Pty) Ltd will investigate formal claims that subsidence has been induced by its mining activities to ascertain its responsibility for the impact. Where it is clear the Emang Mmogo(Pty) Ltd has caused the subsidence, the Emang Mmogo(Pty) Ltd will implement appropriate mitigation measures timeously. These mitigation measures may include repair of damaged infrastructure and landscaping and rehabilitation. It is, however, unlikely that subsidence and subsidence-related impacts will occur at the Emang Mmogo(Pty) Ltd .
Soils	
Target: Soil degradation through mining activities to be managed to ensure that effective rehabilitation measures are in place.	
Soil erosion	Avoid bare, disturbed surfaces for long periods (e.g. re-vegetate stockpiled topsoil). Erosion in the area is to be curtailed especially if the erosion is being caused as a result of the construction activities.
	Any runnels or erosion channels developing during the construction period or during the operational and maintenance period shall be backfilled and consolidated immediately and the area restored to the proper condition. The Emang Mmogo open cast Manganese and Iron mine shall not allow erosion to develop on a large scale before effecting repairs and all erosion damage shall be repaired as soon as possible. Topsoil washed away shall be replaced.
Compaction	Minimise compaction of any topsoil during stockpiling by working the soil in the dry state
	Avoid unnecessary trafficking on any undisturbed areas
	Rip compacted areas affected by the construction to reduce runoff and improve re-vegetation
Erosion due to Storm water runoff	Emang Mmogo(Pty) Ltd shall take measures, to the approval of the Environmental Control Officer (ECO) to ensure that there is no undue Storm water damage and soil erosion resulting from the construction activities inside and outside the mining area.
	Surface storm water shall, where possible, not be allowed to be concentrated and the flow down cut or fill slopes without protection measures being in place.
	Overflow and / or scour channels shall be lined with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge shall be at a point where there is dense natural grass cover. These channels shall not discharge straight down the contours but shall be aligned at such an angle to the contours that they have the least possible gradient.
	Storm water runoff from the stockpile sites and other related areas must be directed into the storm water system when the necessary pollution prevention measures such as a silt traps and may not run freely into the immediate and surrounding environments.
Vegetation	

Target: To ensure that the required removal of flora is limited to the footprint and the mitigated against as far as possible	
Vegetation clearance	A control programme will be implemented to curb the spread of invader and exotic species occurring on the portions of the farm under the control of the mine.
	All landscaping must take place with indigenous species occurring in the area.
	Access roads must be kept to a minimum, and where possible existing tracks should be used.
Fire hazards	The Emang Mmogo(Pty) Ltd and the landowners adjoining the Emang Mmogo(Pty) Ltd area should collaborate in the development and implementation of a fire management program whereby firebreaks are designed and applied and there is emergency preparedness in the event of wildfire arising on the Emang Mmogo(Pty) Ltd property. The fire management program would be applied along the boundaries and an agreement should be reached with landowners adjacent to the Emang Mmogo(Pty) Ltd only to only burn on their side of the fence line if possible.
Animal Life	
Target: To ensure that the required removal of fauna is limited to the footprint and the mitigated against as far as possible	
Loss of sensitive species	No operational activity will occur within the 1:100 year floodline or closer than 100m from the centre of any watercourse.
	If any Red Data species is found, it is recommended that this species be relocated to the nearest conservation area or natural open space with suitable habitat for the particular species to continue its life history. This should be done with the full knowledge and approval of the relevant conservation authority.
	• Prevention of overspill of the mining activities onto the surrounding environment by making sure that clearance is only confined to the proposed site; • Power line pylons should, as far as possible, not be placed in areas where erosion has already occurred or is likely to occur as this may exacerbate the problem; • Power line pylons should preferably not occur in Riparian areas, rivers and streams or dry watercourses or within the 1:100 years flood line of any of these; • Access roads should be kept to a minimum, and where possible existing tracks should be used; • New access roads should be aligned so as to remain on the flattest terrain possible for as long as possible; • Roads should not be constructed in Riparian areas, rivers or streams or dry watercourses or within the 1:100 years flood line of any of these unless no other alternative can be found. Where roads must be constructed through these areas, sufficient culverts should be provided to allow water to flow through; • Construction vehicles should remain only in the area to be disturbed by the road and other works at the time. Disturbance should be restricted to the

	actual project area; • The use of herbicides should be limited as far as possible. Herbicides should only be used under strict control and only when no other options are available. Herbicides should not be used near sensitive environments especially Riparian areas; • Materials such as sand and stone should, wherever possible, be sources from areas which are free of alien plants; • An important aspect of ongoing maintenance is the monitoring of the rehabilitated sites and access road verges for alien plant species; and • Should alien plant species be identified then these should immediately be removed.
Fragmentation of faunal populations	Ensure that no hunting or snaring of animals will occur.
Disturbance to fauna	Ensure that the water quality of the discharged storm water conforms to the necessary national requirements.
	Ensure that the rehabilitation of the site adequately prevents the occurrence of contaminated soil and water.
	Inform and educate staff on the sensitivity of the natural habitats.
Surface water	
Target: To ensure that mining activities do not negatively impact on the aquatic systems by implementing management programs to effectively monitor water quality, water management practices and mitigating measures.	
General	Design, construct and operate Emang Mmogo (Pty) Ltd in strict accordance of Regulation R704 in terms of the National Water Act of 1998 (Act No. 36 of 1998).
Pollution of surface water	The storm water system, especially the discharge points, must be inspected and damaged areas must be repaired if required.
	Discharge points must be inspected for blockages of any kind; these must be removed timeously to ensure the efficient operation of the storm water management system.
	Create diversion channels to ensure that no clean water flows across the operational site.
	All diverted and pumped water shall be discharged at locations on the surface from which it cannot re-enter the works and in a manner, which does not cause erosion, pollution or nuisance.
	WASTECH must dispose of waste oil or other hydrocarbons from workshops and other areas.

	Before any work is carried out in any area of the site all specified or directed or approved pollution control measures shall be in place and operational.
	Encourage and teach workers not to litter.
	Te following mitigation measures must be implemented: • Prevention of overspill of mining activities, and associated activities into the surrounding streams and rivers. Implementation of the necessary monitoring and management programmes to ensure the integrity of all water resources in the area during the construction, and operational lifespan of the mine; • Containment of return waters in a clay lined return water dam; • Re-cycling of contaminated runoff waters from lined settling and evaporation dams; • Sealing of process waters circuit and containment structures; • Separate clean and dirty water systems; and • Provide sufficient storage capacity to contain contaminated waters i.e. adopt a zero discharge policy.
	Clean and dirty water must be separated. Dirty water must be adequately contained in dams.
Disturbance of Riparian areas	Plan operational phase of the mine to avoid any impact on the natural drainage of the site and Riparian functionality
	Provide permeable surfaces to address increased runoff volumes at source and allow infiltration of the runoff.
	Implement and ecologically sensitive Storm water management plan that includes not allowing Storm water to be discharged directly into the identified buffer zone of the watercourse and drainage.
	Ensure that the following control measures are in place to prevent oil, grease, fuel or chemicals from reaching a water resource: • The fuel supplier shall provide and maintain bud walls around his fuel storage facility within the site. Such walls shall be of a sufficient height to contain 110% of the entire contents of his fuel storage facility. • Soil contamination by oil, fuel or chemical leakage shall either be removed and placed in disposal areas as directed by the Emang Mmogo resources Environmental Centre or shall be rehabilitated *in situ*. • All relevant staff are to be trained on waste management and petro-chemical spill ISO 14 001 procedures according to the training matrix; • All spillages of oil onto concrete surfaces shall be controlled by the use of an approved absorbent material;

	• All old oil shall be retained for re-use/recycling by the supplier / recycling company; • Concrete shall be mixed only in areas, which have been specifically demarcated for this purpose. All concrete that is spilled outside these areas, shall be promptly removed and taken to an approved landfill site. After all concrete mixing is complete, all waste concrete shall be removed from the batching area and disposed of at an approved landfill site. Storm water shall not be allowed to flow through the batching area; • Disposal of waste oil or other chemicals from workshops and other areas shall not cause pollution of rivers, streams or soil. • No mining activities should take place within buffered the Riparian areas or in their associated buffer zones; • Riparian areas and their associated buffer zones should be fenced during the construction phase to prevent any human activity from encroaching onto these areas; • Riparian areas outside the study area that are affected by access to the site by machinery and the labour force should also be fenced off and protected; • No animals may be trapped, hunted or handled in any way; • No vegetation may be collected or used for firewood
Ground water	
Target: To ensure that mining activities do not negatively impact on the Ground water systems, by implementing management programs to effectively monitor water quality, water management practices and mitigating measures.	
Pollution of underground water resources	Separate clean and dirty water systems;
	Seal shallow ground water influxes into mine workings;
	Provide sufficient storage capacity for contaminated runoff and process waters;
	Construct suitable facilities to prevent seepage/infiltration and to contain;
	• To assess the impacts of the stockpile area on the groundwater regime a groundwater analysis need to be undertaken; • A contaminant plume after 5, 10, 15, years should be modelled. Contaminated groundwater from the stockpile area will migrate and this assessment need to determine the direction and propose possible mitigation measures; • The contaminant plume could result in an impact on downstream water bodies, aquatic ecosystems and surrounding landowners, especially in the

	long term (more than 50 years); • Disposal of Manganese and Iron stockpile on natural clay; • 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 bermed 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 Controlling Officer. These materials include fuel, oil, cement, bitumen etc. • Surface water draining off contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils. • All materials liable to spillage are to be stored in appropriate structures with impermeable flooring. • Portable septic 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.
Ground water Level impact - dewatering	A Ground water and surface water monitoring programme should be planned and implemented prior to the commencement of mining.
	Monitoring boreholes should be established as soon as infrastructure design is completed and approved.
	Monitoring boreholes should be constructed and sited according to DWAF standards and guidelines.
	Water level and quality monitoring should commence when the construction of the box cut commences.

Air Quality	
Target: To ensure that the impact caused by the operational activities regarding air pollution is managed by employing sound management principles based on best practical environmental options that comply with legal and other requirements. It is recommended that the project proponent commits to air quality management planning throughout the various operations of the mine.	
Dust/Air pollution	It is recommended that an Air Pollution Control System (APCS) be developed for Emang Mmogo Open cast Manganese and Iron mine to reduce and control all main contributing sources. This APCS includes detailed management plans, mitigations measures and monitoring and operational procedures developed for each significant source of emissions to ensure emissions reductions will occur. The APCS must be implemented and revised by mine personnel on an on-going basis. This APCS can be incorporated into the EMS (Environmental Management System) of the mine.
	Appropriate measures must be undertaken to minimise the generation of dust as a result of the works, operations and activities to the satisfaction of the Environmental Control Officer on the Emang Mmogo(Pty) Ltd site. Such measures shall include regular and effective re-vegetation, maintenance and monitoring of the rehabilitated mined area.
	The absence of visible dust plume at all tipping points and outside the primary crusher would be the best indicator of effective control equipment in place. In addition the dustfall in the immediate vicinity of various sources should be less than 1200 mg/m2/day. From all activities associated with Emang Mmogo Open cast Manganese and Iron mine, dustfall levels should not exceed 600 mg/m2/day.

Dust Fallout Monitoring Network	• It is recommended that a dust fallout monitoring network be put in place for the proposed Emang Mmogo Open cast Manganese and Iron mine operations. This would provide management with an indication of what the increase in fugitive dust levels are once mining operations commence and would bring the mining operations in line with the new Air Quality Act (no.39 of 2004). • Dust fallout monitoring at the proposed mine may include placing dust fallout buckets close to the primary crusher and concentrator plant. Single dust fallout buckets can also be placed close to the sensitive receptor areas, especially neighbouring farms and communities as these are located closer to the proposed mine site compared to Middelburg. It is also proposed that a directional twin dust bucket be located to the west, halfway between the proposed mine site and Manganese and Iron loading site for the capturing of dust fallout from each operation and to determine the dust fallout contribution of each operation. • However, it should be taken into account that directional twin dust buckets are expensive and difficult to maintain. The analysis of the four directional dust fallout buckets should preferably be linked to the frequency of the wind direction (from the four sectors) and the monthly results be presented as total daily dustfall over a month (28 to 32 days) as set out by the DEAT dust fallout categories.
Materials handling operations	Crushing operations must be enclosed in order to reduce dust. The following mitigation measures can be implemented: • Water sprays; • Enclosure of storage piles where tipping occurs. The Australian NPi indicates that a telescopic chute with water sprays would ensure 75% control efficiency and enclosure of storage piles where tipping occur would reduce the emissions by 99%. According to the Australian NPi, water sprays can have up to 50% control efficiency, and hoods with scrubbers up to 75%. If in addition, the scrubbers and screens were to be enclosed, up to 100% control efficiency can be achieved. With these control measures in place, the impacts would reduce to negligible levels. Chemicals mixed into the water will not just save on water consumption but also improve the control efficiency of the application even further.
PM 10 concentrations and dust fallout	For the paved road, it is recommended that dust fallout in the immediate vicinity of the perimeter be less than 1200 mg/m2/day.
	Wet suppression or chemical stabilization of unpaved roads.
	The extent of open areas needs to be kept to a minimum.
	Reduction of unnecessary traffic.
	Strict speed controls are to be enforced.

Emissions from vehicles	Vehicles and machinery must be serviced regularly to ensure that vehicle emissions are kept to a minimum.
Health and safety	Workers must be issued with the necessary protective equipment when working in conditions that may progressively have detrimental affects on their health.
	Ensure that staff is suitably trained in the use of the protection equipment.
	Ensure regular audits to monitor the effectiveness and abidance to the protection guidelines.
	Implement disciplinary measures to ensure compliance to the programme.
Inspections and audits	• It is recommended that site inspections and progress reporting be undertaken at regular intervals (at least quarterly) during operations, with annual environmental audits being conducted. • Annual environmental audits forms part of an APCS and should be initiated at Emang Mmogo Open cast Manganese and Iron mine. • Results from site inspections and off-site monitoring efforts should be combined to determine progress against source- and receptor-based performance indicators.
Communication to interested and affected parties	• Progress should be reported to all interested and affected parties, including authorities and persons affected by pollution. • Corrective action or the implementation of contingency measures must be proposed to the stakeholder forum in the event that progress towards targets is indicated by the quarterly/annual reviews to be unsatisfactory. • Stakeholder forums provide possibly the most effective mechanisms for information dissemination and consultation. EMPs should stipulate specific intervals at which forums will be held, and provide information on how people will be notified of such meetings.
Noise	
Target: Ensure that the impact caused by the disruption of ambient noise levels and or increase in continuous noise levels are assessed and recorded and complies to the relevant legal requirements governing noise pollution	
General	Ensure that all machinery and vehicles are well maintained and road worthy.
	Noise at equipment and machinery point sources should be damped through acoustic treatment and applying silencing equipment.
	Environmental noise monitoring should be carried out at regularly to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted.
	Regularly (i.e. every six months) conduct a noise audit of the site.

	Erect warning signs where noise levels exceed the 85 dBA noise level.
Blasting vibrations	Atmospheric conditions should be considered before charging and blasting.
	Blasting vibrations should be controlled by means of optimising blasthole geometry and altering the time of blasting.
	Implement a dust and noxious gases minimization strategy that will reduce the impact of atmospheric pollution. This will include the use of noxious gas fixation techniques, using and adhering to blasting schedules, and strategies that minimize dust generation.
	Affected communities must be notified when blasting is scheduled to take place.
Health and safety	Workers must be issued with the necessary protective equipment, including ear plugs, when working in conditions that may progressively have detrimental affects on their health. Ensure that all personnel have access to hearing protection equipment at sites where the 85 dBA noise level is frequently recorded. Issuing of hearing protection will conform to the Emang Mmogo(Pty) Ltd Strategy.
	All employees, who operate machines/tools which are identified as noise sources, should be subjected to audiometric examinations.
	All hand held machines will be muffled.
	All fans will be silenced
Complaints	If complaints about disturbing noise are received from the local community, Emang Mmogo(Pty) Ltd will: • respond immediately to the complaints; • identify the noise source; • implement appropriate mitigatory measures in consultation with the affected party.
	The responsible environmental officer will investigate all complaints and/or non-compliances and the necessary actions will be taken.
Visual Aspects	
Target: To ensure that extensive scaring of the landscape does not take place as a result of the operational phase by implementing good rehabilitation procedures.	
Scarring of the environment	Areas where vegetation and or topsoil has been stripped to establish facilities that will be removed with the completion of the construction phase must be restored to the pre-disturbance state, by clearing waste, spreading topsoil and re-establishing vegetation cover.
Construction activities	The Emang Mmogo(Pty) Ltd shall not establish or undertake any activities, which in the opinion of the Environmental Control Officer, are likely to adversely

	affect the scenic quality of the area by referring to the activities' texture, scale, locality and appearance. The Environmental Control Officer may direct the Emang Mmogo(Pty) Ltd to refrain from such activities or to take mitigatory actions to reduce the adverse effect of such activities on the scenic quality of the environment;
Design of the plant and associated infrastructure	The colours of all permanent structures shall be chosen so as to blend in with the dominant colours of the surrounding landscape. Painted surfaces shall be painted with non-reflective (matt) colours, preferably with a grey hue.
Socio-Economic Structure	
Target: To ensure that the socio-economic status of the communities are not detrimentally affected by the construction operations	
Inflow and outflow of temporary workers and the pressure on infrastructure	The mine must maintain the existing human resource development plan to enhance the use of local skills and further develop local skills.
	All labour should as far as practically possible be sourced from the local communities.
Traffic	Ensure drivers and operators of equipment are familiar with the safety policies.
	Vehicular traffic on site should be limited within an 80 km/h speed limit.
	Only main roads should be used.
	Where feasible, vehicles should not operate on public roads during peak hours.
	All vehicles entering and leaving the site should be road worthy.
	Integrate the road layout with the attributes of the biophysical, social and economic setting to reduce the extent of change and disturbance to these.
	Communicate with and acknowledge the concerns of the I&AP's and mitigate where possible.
	Maintain effective communication links with the local communities.
Safety Risks and Hazards	Design, implement and enforce an appropriate Safety, Health and Environment (SHE) programme that includes the use of PPE to ensure the well being of staff
	Implement a dust and noxious gases minimization strategy that will reduce the impact of atmospheric pollution. This will include the use of noxious gas fixation techniques, using and adhering to blasting schedules, and strategies that minimize dust generation.
	Emergency preparedness is required for (among other things) spillages of hazardous substances which would impact on animals, plants and Riparian areas. In this regard the Emang Mmogo(Pty) Ltd shall: • carry out a risk analysis for sections where spillage would have the most severe consequence;

	• develop a strategy and management action plan in collaboration with existing emergency services.

9.6 DECOMMISIONING AND CLOSURE PHASE

Table 31: Mitigation measures to be implemented during the decommissioning phase of the Emang Mmogo open cast Manganese and Iron mine

Issue	Mitigation
Flora	
Target: To ensure a stable and sustainable environment for all indigenous flora of the area	

Issue	Mitigation
Reduced vegetation cover	All exposed areas will be re-vegetated, where possible.
	Ensure, that all re-vegetation strategies utilise indigenous vegetation types.
Air quality	
Target: To ensure a that the air quality is not detrimentally affected during the decommissioning phase	
Respirable dust (PM10) impacting on human health and dust fallout	Utilisation of suitable wet suppression methodologies during decommissioning.
	Revegetation of open areas.
Noise	
Target: Ensure that the impact caused by the disruption of ambient noise levels complies to the relevant legal requirements governing noise pollution	
Increase in ambient noise during decommissioning	Fit efficient silencers and enclose engine compartments.
	Damp mechanical vibrations of machinery used for dismantling.
	Demolition activities should be kept, where possible, to daylight hours.
Visual	
Target: To ensure that extensive scaring of the landscape does not take place as a result of decommissioning	
Visual Impact	All buildings are to be demolished, unless otherwise requested by the Local authority, representatives from the tribal authority, or any other suitable person.
	The rock dumps could be reclaimed

9.6.1. Infrastructure areas

- The removal, decommissioning and disposal of all mining infrastructure, will comply with all conditions contained in the Mineral and Petroleum Development Act, 2002 (Act No. 28 of 2002).
- To this end the decommissioning and rehabilitation of all infrastructure areas will follow the following principles:
- All vehicles, plant and workshop equipment will be removed for salvage or resale.
    - All fixed assets that can be profitably removed will be removed for salvage or resale.
    - Any item that has no salvage value to the mine but could be of value to individuals will be treated as waste.
    - All structures will be demolished and terracing and foundations removed to the lesser of 500mm below the original ground level.
    - The excavations will be filled in with soil, the top 150mm being topsoil (from stockpiles).
    - Paved roads will be ripped up, the wearing course treated as waste and the sub-base ripped or ploughed and covered with 150mm topsoil.
    - Inert ceramics such as bricks, concrete, gravel etc. will be used as backfill or disposed of in a permitted waste disposal site.
    - Inert waste, which is more than 500mm underground, such as pipes will be left in place.
    - Inert ceramic and buried waste with a salvage value to individuals such as scrap metal, building materials, etc. will be removed and disposed of at a proper facility.
    - All disturbed and exposed surfaces will be covered with at least 150mm of topsoil and re-vegetation must be allowed to take place naturally.
    - Water quality will be monitored until it reaches a steady state or for three years after closure.
    - Dismantle and remove redundant fence for salvage.
    - Demolish all concrete fence foundations to 500mm below the original ground level.

- Cover the fence line with topsoil.
- All services such as the water supply line and the power line will be demolished only for the section on the mine's property.

9.6.2. Submission of information

- All facilities that become redundant during the life of the mine must be rehabilitated concurrently to lighten the rehabilitation process at the end of the mine's life.
- Attention must be paid to the latest developments in the mine rehabilitation sciences.
- The mine closure plan must always keep pace with the current best practices so it must be reviewed every five years.
- All information as required by the various government departments should be captured and be readily available for submission when required.

9.6.3. Maintenance

- The necessary agreements and arrangement will be made by Emang Mmogo(Pty) Ltd to ensure that all natural physical, chemical and biological processes for which a closure condition have been specified are monitored until they reach a steady state or for three years after closure or as long as deemed necessary at the time.
- All rehabilitated areas will be monitored and maintained until such time as required to enable the mine to apply for closure of these different areas.

9.6.4. Performance Assessments

- As per the MPRDA and associated Regulations GN 7949 this Environmental Management Programme will be continually assessed in terms of its appropriateness and adequacy. In order to achieve such ends Emang Mmogo(Pty) Ltd will undertake the following:
- Implement the necessary monitoring programmes, as discussed as part of this EMP;
- Conduct performance assessments of this EMP as required by the MPRDA and associated Regulations; and
- Compile and submit the aforementioned performance assessment reports to the DME.

- The frequency of the performance assessments will be once within the first 6 months of construction (once construction activities have been initiated) and thereafter every two years.
- An independent and competent person will undertake all performance assessments.

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12. ANNEXURES

Annexure 1: Authority correspondence

Annexure 2: Public Participation

Annexure 3: Specialist Studies