caseID: 1341

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Private Bag X6093, Kimberley, 8300, Tel: (053) 807 1700, Fax: (053) 8325 631
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From: Directorate: Mineral Regulation: Northern Cape **Date: 08 October 2010**
Enquiries: Ms Azwihangwisi Nemulodi E-mail: azwi.nemulodi@dmr.gov.za

Ref: NC30/5/1/2/3/2/1/269 EM

The Director
South African Heritage Resources Agency
PO Box 4637
CAPE TOWN
8000

ATTENTION: MARY LESLIE

CONSULTATION IN TERMS OF SECTION 40 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT 2002, (ACT 28 OF 2002) FOR THE APPROVAL OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME FOR A MINING RIGHT IN RESPECT OF MANGANESE AND IRON ORE ON PORTION 1 AND REMAINING EXTENT OF FARM KAREEPAN NO. 450 AND PORTION 1 OF THE FARM PENSFONTEIN NO. 449 SITUATED IN THE MAGISTERIAL DISTRICT OF KURUMAN, NORTHERN CAPE REGION, APPLICANT: MISTY FALLS 45 PTY LTD.

Attached herewith, please find a copy an amended EMP received from the above-mentioned applicant, for your comments.

It would be appreciated if you could forward any comments or requirements your Department may have to this office and to the applicant on or before **08th December 2010** as required by the Act.

Consultation in this regard has also been initiated with other relevant State Departments. In an attempt to expedite the consultation process please contact **Azwihangwisi Nemulodi** of this office to make arrangements for a site inspection or for any other enquiries with regard to this application.

Your co-operation will be appreciated.

pp .....
REGIONAL MANAGER: MINERAL REGULATION
NORTHERN CAPE REGION

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The Proposed Mining of Manganese Ore and Iron Ore on Kareepan

Environmental Impact Assessment Report and Environmental Management Plan

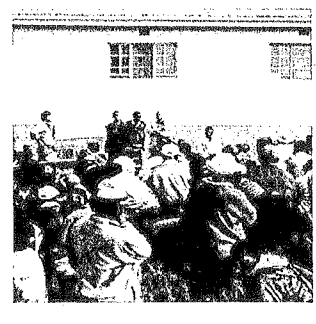
Version - Final

July 09

Client Name: Misty Falls 45 (Pty) Ltd.
Project Number: 00254/000/000/09-060







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Misty Falls 45 (Pty) Ltd.
00254/000/000/09-060

DOCUMENT ISSUE STATUS

Report Issue	Final		
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	Name	Signature	Date
Author	Pieter Snyders		27 July 2009
Document Reviewer	Simon Charter		27 July 2009
Document Authorisation	Ferdi Pieterse		27 July 2009

I. EXECUTIVE SUMMARY

Background

Misty Falls 45 (Pty) Ltd has applied for a mining right in respect of Iron ore and manganese ore on the Remaining Extent and Portion 1 of the farm Kareepan No. 450 and the Remaining Extent of the farm Pensfontein No. 449 which is approximately 2872 ha in size, situated approximately 6 km north of Postmasburg adjacent to the R325. The study area falls under the Kuruman Registration District, which is located in the Northern Cape Province of South Africa and is located within the borders of the Tsantsabane Local Municipality, which forms part of the Siyanda District Municipality.

Large parts of the study area have been disturbed by historical mining activities and were left un-rehabilitated. The surrounding land uses are predominantly mining and livestock farming.

Project description

The proposed mining activities will consist of the processing of ore dumps located within the borders of the study area, as well as continuous drilling and prospecting activities to establish the viability and extent of the in-situ resource. Thus the in-situ resource will not be added into this application and will only form part of the ongoing prospecting activities. Should the mining of the in-situ resource be classified as viable, the EIA/EMP must be amended for the mining thereof.

Existing infrastructure

At present the existing surface infrastructure in the study area can be summarised as follows:

- Old buildings from historical mining activities;
- Old open cast pits from historical mining activities;
- Power lines; and
- Various gravel access roads.
- Power lines; and
- Various gravel access roads.

New Infrastructure

This proposed project will consist of the following additional infrastructure:

- A new processing plant;
- Upgrading of historical mining building with toilet facilities;
- Upgrading of historical mining building with food preparation facilities;
- Upgrading of historical mining building with food preparation facilities;
- An 25 000 l diesel storage tank; and
- Upgrading of an old building to a vehicle service area.

Project Motivation

The benefits of the proposed mining operation are detailed below.

Provision of sustainable employment

The proposed mining operation will employ thirty (30) workers from within the borders of the Tsantsabane Local Municipality. It is anticipated that the proposed mining operation will positively impact on the lifestyles of these thirty (30) 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.

Provision of a regional socio-economic benefit

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.

Improved environmental management commitments

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. All these processes will be introduced into the financial provision for closure of the proposed mining operation.

Public Participation

The stakeholders where notified in the following ways:

Site notices

Site notices were placed at the entrances of the study area by the applicant

Media advertisements

Media advertisements were placed in the DFA (regional newspaper) and the Volksblad on 26 February 2009. This advert contained the information required in terms of Government Notice R385 of the National Environmental Management Act (no. 207 of 1998)

Telephonic consultation

Most land owners were contacted telephonically with the purpose of informing these parties about the proposed mining activities of the applicant, explaining the application process and enquiring about any potential objections or concerns regarding the proposed project.

Background Information Documents

GCS made a Background Information Document (BID) available to all I&AP's / stakeholders via e-mail, fax and/or post. The BID included details of the proposed project as well as the Scoping and EIA / EMP purpose, requirements and process. It also included relevant contact details and a comment / registration sheet. I&AP's were invited to register and send responses by letter, fax, telephone or e-mail to GCS.

Issues Raised

No objections where raised by stakeholders to the proposed mining operations.

Identified impacts

Geology

No additional impacts are envisaged. Only the mining of existing ore dumps will occur.

Topography

No additional linear infrastructure (railway line and gravel roads) will require topographical alterations. Additional buildings and operational infrastructure will have a small significance due to the highly disturbed nature of the application area.

The product and rock waste dumps will be kept to a minimum size during the operation phase. A positive impact will occur during the decommissioning phase due to rehabilitation and landscaping activities.

Soils, land use and land capability

The proposed mining operation will have limited impacts on soils, land use and land capability as most activities will take place within the highly disturbed area that contain little or no topsoil and vegetation.

Hydrocarbon spills during the construction activities, the operation of the diesel loading and hauling vehicles, the operation of the plant, and the maintenance of vehicles and machinery may result in the contamination of soils. The significance of these impacts can be greatly reduced by implementing the management measures pertaining to the handling of hydrocarbons and the cleaning up of spills.

The stripping of vegetation will lead to the exposure of soils, which would make them susceptible to soil erosion. Improper storm water management could also lead to soil erosion and a loss of soil capability.

Fauna and flora

The Historical mining activities and current prospecting activities on site have already led to the disturbance of local fauna. It is therefore unlikely that there will be further impacts associated with the proposed activities.

The proposed mining will take place within the highly impacted mine area and will require no floral stripping. Vegetation will have to be stripped in the proposed plant area. All protected plant species that have been identified will be geo-referenced and permits will be obtained prior to their removal if necessary.

Surface water

It should be noted that there is no permanent surface water present on the proposed mining area, only non-perennial rivers. Therefore, the occurrence of impacts associated with surface water is very low. However these impacts have been discussed due to the fact that there might be an impact on surface water outside the application area.

Hydrocarbon spills during the construction activities, the operation of the diesel loading and hauling vehicles, the operation of the plant, and the maintenance of vehicles and machinery may result in the contamination of surface water. The significance of these impacts can be greatly reduced by implementing the management measures pertaining to the handling of hydrocarbons and the cleaning up of spills.

Groundwater

Groundwater abstraction will be required for processing and potable usage.

Large-scale hydrocarbon spills could result in groundwater contamination. This is unlikely due to the groundwater depths in the area. The significante of the impacts can be reduced even more by implementing the management measures pertaining to the handling of hydrocarbons and the cleaning up of spills.

Air quality

The increase in vehicular traffic on site and the stripping of vegetation will increase dust emissions. The significance of these impacts can be greatly reduced by implementing dust management and suppression measures. The significance of the air quality relating to vehicular emissions can be reduced by maintaining all vehicles and machinery.

Noise and vibrations

Some of the proposed activities on site will contribute to the ambient noise emissions in the area. This will have a limited additional impact due to current existing mining activities in the neighbouring areas and the low population of the area. The significance of the impacts can be reduced by implementing noise management measures and maintaining all vehicles and equipment.

Heritage

No heritage resources of high significance will be impacted by the proposed activities.

Visual

The product and waste rock stockpile will be placed in an already visually impacted area and their sizes will be kept to a minimum and will cause little further visual disturbances. Any dust emissions will that could have a visual impact will be handled in the air quality section.

A positive visual impact will occur during the decommissioning phase due to the rehabilitation and landscaping of the historically disturbed areas.

Socio-economic

The proposed mining operation will employ thirty (30) workers from within the borders of the Tsantsabane Local Municipality. It is anticipated that the proposed mining operation will positively impact on the lifestyles of these thirty (30) individuals by providing them with a reliable source of income and implementing the Human Resource Development Plan as contained in the Social and Labour Pan.

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. This would contribute to the flow of foreign capital into the South Africa.

Conclusion

When considering all of the environmental impacts outlined above, it is evident that there are no impacts that can be considered highly significant after the required management measures have been implemented. This is primarily due to the highly disturbed nature of the site due to historical mining activities.

For this reason, it is recommended that the activities outlined above be approved provided the following conditions are met:

- The provisions stipulated within the holistic EMP compiled on behalf of the mine and submitted to the DME are complied with.

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1. INTRODUCTION

1.1 Background

Misty Falls 45 (Pty) Ltd has applied for a mining right in respect of Iron ore and manganese ore on the Remaining Extent and Portion 1 of the farm Kareepan No. 450 and the Remaining Extent of the farm Pensfontein No. 449 which is approximately 2872 ha in size, situated approximately 6 km north of Postmasburg adjacent to the R325. The study area falls under the Kuruman Registration District, which is located in the Northern Cape Province of South Africa and is located within the borders of the Tsantsabane Local Municipality, which forms part of the Siyanda District Municipality.

Large parts of the study area have been disturbed by historical mining activities and were left un-rehabilitated. The surrounding land uses are predominantly mining and livestock farming.

The proposed mining activities will consist of the processing of ore dumps located within the borders of the study area, as well as continuous drilling and prospecting activities to establish the viability and extent of the in-situ resource. Thus the in-situ resource will not be added into this application and will only form part of the ongoing prospecting activities. As soon as the in-situ resource is classified as viable, the EIA/EMP must be amended to indicate where proposed open cast pits will be located and what mining method will be utilized.

A Mining Right Application (MRA) was submitted to the Department of Minerals and Energy (DME) by Misty Falls 45 (Pty) Ltd. Acceptance of this application was received on 27 January 2009. Following the acceptance by the DME a Scoping Report was required to be compiled and submitted. The Scoping Report in terms of Regulation 49(2) of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA) was submitted to the relevant authorities on 2 March 2009. An Environmental Management Programme (EMP) was then compiled in terms of Section 39(1) and Regulation 51 of the MPRDA and an Environmental Impact Assessment (EIA in terms of Regulation 50 of the MPDA were then required. This document serves as the EIA component of the EIA/EMP and must be submitted to the Regional Director of Mineral Development at the DME for approval. Should the EMP be approved by the DME, the provisions presented therein must be implemented throughout the life of the mine until closure is granted. The DME will be the lead authority with regard to the above-mentioned application.

1.2 Applicant Details

Name of Company	Misty Falls 45 (Pty) Ltd.
Registration Number	2005/028037/07
Postal address	c/o Mr. Gamza Gool 10 Otto Street Homestead KIMBERLEY 8301
Physical address	c/o Mr. Gamza Gool 10 Otto Street Homestead KIMBERLEY 8301
Landline	053 871 5426
Facsimile	053 871 5426

1.3 Land Owner Details

Name of Land Owner	Trustees of the Kareepan Trust
Name of Contact Person	Chris Victor
Postal address	P.O. Box 589 POSTMASBURG 8420
Landline	053 313 2598
Cell phone	076 397 1608

1.4 Title Deed Description

Table 1-1: Title Deed description of the affected portions of the proposed mining area

Farm Name	Portion	Registration Division	Size	Surface Owner and Title Deed	Address
Kareepan No. 450	RE	Hay RD	1276,9842 Ha	Trustees of the Kareepan Trust T 1782 of 2006	P.O. Box 589 POSTMASBURG 8420
	1		1276, 9842 Ha	Trustees of the Kareepan Trust T 1782 of 2006	
Pensfontein No. 449	RE		342.6182 Ha	Trustees of the Kareepan Trust T 1782 of 2006	

1.5 Environmental Impact Assessment Practitioner Details

Misty Falls (Pty) appointed GCS (Pty) Ltd to undertake the necessary environmental assessments and to ensure that all legislative requirements are adhered to as part of the environmental authorisation process.

GCS (Pty) Ltd provides a professional and cost effective consulting service in the fields of water, environmental and earth sciences. The Directors of GCS have over 50 years of mining, exploration and consulting experience in Southern Africa. GCS has a team of highly trained staff with considerable experience in the fields of hydrogeology, geology, water management and social and environmental science.

Table 1-2: EAP project team

Name	Position	General Qualifications	Years of experience in EIAs and EMPs
Pieter Snyders	Junior Environmental Scientist	• B.Sc - Biochemistry and Zoology (NWU) • B.Sc (Hons) – Geography and Environmental Management (NWU)	
Simon Charter	Environmental Project Manager / Senior Environmental Scientist	• B.Sc - Environmental Science and Zoology (UCT) • B.Sc (Hons) - Environmental Science (UCT) • MSc Environmental Management (UCT) • Management Systems Auditor - ISO 14001:2004; ISO 9001:2001 & OHSAS 18001:1999 (RABQSA & SAATCA) • Carbon Footprint Analyst	3
Ferdi Pieterse	Senior Project Manager	• B.Sc - Geography, Environmental Management and Geology (RAU) • B.Sc (Hons) - Geography and Environmental Management (RAU)	7

1.6 Description of Mining Activities

1.6.1 Mineral Deposit

Numerous large historical dumps can be found on the property. These dumps are the waste piles of the previous manganese mining activities where only grades in access of 45 to 48 percent were sorted out. As a result these old dumps have potential as a cost effective and convenient manganese resource. A majority of the dumps have been surveyed and labeled. Representative samples were taken on surveyed dumps at predetermined points based on the geometry of the dumps. Samples were crushed and washed to remove waste, material smaller than 1mm in size as well gangue material. The resultant product, comprised of bigger and small fraction manganese ores, was hauled to SGS Lakefield Research Africa for physical and chemical analysis. The results of this analysis indicate that the ore in the

dumps is hard and tough with minimum of fines and stands up very well to transport. Chemically, the ore conforms to either metallurgical grade but not Battery and Chemical grade requirements, the Manganese varying from 25 to 40 % with the ratio of manganese to iron being between 3:2 and 4:1. Phosphorus content is less than 0.05 %.

1.6.2 Estimated Reserve

70 % of the dumps on the application area have been surveyed, sampled and analyzed. The following resource statement was arrived at from the volumes of dumps surveyed and analyzed. Resources on the 30% of the dumps still have to be surveyed, sampled and analyzed was inferred from the dumps, i.e. the height and circumference of dumps. (Refer to Table 1-3)

Table 1-3: Ore dumps resource estimates

Category	Tonnes(Mtons)	%Mn	Tons at 60 % Recovery
Indicated	300 000	35	200 000
Inferred	1 142 857	35	1 285 714
Total	4 142 857	35	3 285 714

1.6.3 Mining Method

Prospecting operations have focused on sampling and treating of ore from the dumps and the same operation will be followed when exploiting the dumps although at a bigger scale. The current infrastructure and technical resources can handle a production rate of 600 tonnes of saleable material per day. For the first 5 years of the proposed mining operation the only two activities that will occur are the mining of dumps and the clearing of 40% of the mining surface area to allow space for prospective drilling to establish the extent and viability of the in-situ resource. Thus the in-situ resource will not be added into this application and will only form part of the ongoing prospecting activities. If an in-situ resource is found, the EIA/EMP must be amended to indicate where proposed open cast pits will be located and what mining method will be utilized.

The selected mining method was designed based on the nature of the ore dumps. This process involves the ore from the different dumps being processed at a central plant and temporarily stored in two product stockpiles. Waste will be loaded, hauled and dumped in historical quarries and trenches. The mining sequence was developed so that space will be created for prospective drilling the in-situ resource according to a pre-defined grid. The drilling process forms part of the prospecting activities that has been approved in the prospecting right application and does not from part of the actual mining of the ore dumps.

A front-end loader capable of loading 40 ton trucks in three passes will be used, after which the ore will be hauled from the dumps to a crushing and conveyor system. Ore loaded onto trucks will be hauled to a crusher. The resultant product will be transferred via a conveyor belt to a wet screening plant producing lumpy ore or bigger fraction ore (-63mm to +20mm), containing 35 to 38 percent manganese and a smaller fraction ore (-20mm in size) with a manganese content of 35 to 37 per cent manganese.

The following equipment will be used as part of the mining operation:

- Haulers – 5 x CAT 777;
- Loaders – 2 x CAT 992 FEL; and
- Water Trucks – 1 x Bell B40.

Loading and hauling of both waste and ore will be carried out by 15 ton front-end loaders matched with 40 ton rear dump CAT trucks. Working shifts will be arranged so that 750 tons of product, which will mean that a 60% product yield from material put through the crusher, is produced daily.

1.6.4 Planned Life of Mine

The anticipated life of mine of the Kareepan Mine is 30 years.

1.7 Regional Setting

1.7.1 Magesterial District

The proposed mine is situated within the Magisterial District of Kuruman. The farms Kareepan and Pensfontein are situated within the Tsantsabane Local Municipality (NC085), which forms part of the Siyanda District Municipality. Refer to Fig 3-18

1.7.2 Neighbouring towns

Neighbouring towns to the study area include Postmasburg (towards the south), Olifantshoek (towards the north-west) and Kathu (towards the north).

2. METHODOLOGY

2.1 Legislation

- The environmental component of the project will comply with the requirements of; inter alia, the following national and provincial legislation:
- The Constitution of South Africa, 1996 (Act No. 108 of 1996);
- The Minerals and Petroleum Resources Development Act (Act No. 28 of 2002);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998);
- The National Water Act, 1998 (Act No. 36 of 1998);
- The Environment Conservation Act, 1989 (Act No. 73 of 1989);
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- The Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965);
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004);
- The Hazardous Substances Act, 1973 (Act No. 15 of 1973);
- The National Heritage Resources Act, 1999 (Act No.25 of 1999); and
- National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004).

2.2 Environmental Reporting Procedure

The EIA/EMP, compiled in terms of the MPRDA is presented in two stand-alone reports, namely the EIA and the EMP. The objectives of this EIA Report is to:

- Provide a description of the environment in which the project will be situated;
- Assess and do a comparative assessment on all potential alternatives that exist for the proposed project and determine which are the most feasible on an environmental, social and economical level (if relevant);
- Provide feedback on the stakeholder consultation undertaken for the proposed project;
- Identification of the impacts, which could occur as a result of the proposed project based on the nature, extent, duration, probability and significance of the impacts;
- Description of the arrangements for monitoring and management of environmental impacts;
- Identify knowledge gaps and report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information; and
- Assessing and utilising the comments received from all stakeholders, as well as the investigations undertaken by the environmental consultants and specialists, to identify all the impacts, which could occur as a result of the proposed project, accomplish the above.
- Description of the arrangements for monitoring and management of environmental impacts;
- Identify knowledge gaps and report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information.

The EIA (this report), is compiled to address potential impacts specific to the additional proposed activities on site. The EMP is a legally binding report and presents a Programme applicable to all mine related activities and phases.

2.3 Baseline Description (specialist investigations)

Due to the potential environmental, social and cultural impacts that this project may have, certain specialist investigations were undertaken as part of the EIA and EMP in order to determine the nature, extent, duration, probability and significance of these impacts.

- These included:
- Air Quality Impact Assessment;
- Archaeological and Heritage Impact Assessment;
- A botanical study;
- Groundwater; and
- A Traffic Impact Assessment.

No additional specialist investigations were required.

2.4 Environmental Impact Assessment Process

In terms of Section 50 of the regulations promulgated under the MPRDA, the EIA Report must determine the nature, extent, duration, probability and significance of the environmental, social and cultural impacts of the project, along with the reasonable alternatives and the required mitigation measures for each impact during the life of mine.

The following aspects are included in the EIA Report:

- Investigation of the environment likely to be significantly affected by the proposed project;
  - Air Quality Impact Assessment;
  - Archaeological and Heritage Impact Assessment;
  - A Botanical Study;
  - Groundwater; and
  - A Traffic Impact Assessment;
- Investigation of the potential impacts (including cumulative impacts) of the proposed operation and its alternatives on the environment, socio-economic conditions and cultural heritage components;
- An assessment of the nature, extent, duration, probability and significance of the potential environmental, social and heritage impacts of the proposed operations, including the cumulative impacts;

- A comparative assessment of the feasible alternatives and their potential environmental social and heritage impacts;
- Investigation and description of remedial measures for each significant impact of the project and the preferred alternatives to keep the impacts to a minimum;
- Description of the stakeholder engagement process followed during the course of the assessment and an indication of how issues raised have been addressed;
- Reporting on knowledge gaps, the adequacy of predictive methods and the underlying assumptions and uncertainties encountered in compiling the required information;
- Description of the arrangements for the monitoring and management of impacts, and the assessment of the effectiveness of such arrangements after their implementation; and
- Inclusion of technical supporting information as appendices.

These activities have been undertaken within the original EIA and EMP and therefore no changes, other than the alignment to the MPRDA, were required.

2.5 Report Structure

The report structure for the compilation of the EIA is detailed below and will guide the reader to the relevant sections.

Chapter 1 - Introduction

This chapter provides a background to the project, details of the applicant, title deeds descriptions, details of the EAP, details on the local and regional setting, a brief description of current mining activities and a brief description of the proposed activities.

Chapter 2 - Environmental Process

This chapter provides a description to the purpose, approach and methodology followed for the completion of this project. It also described all of the legislation relevant to the application.

Chapter 3 - Baseline Environmental Description

This chapter provides a description of the baseline environment (which includes the bio-physical and socio-economic components) as it pertains to the project. It is

important to note that historical mining already forms part of the current environment.

Chapter 4 - Project Alternatives

This chapter describes potential project alternatives.

Chapter 5 - Detailed Project Description

This chapter provides a detailed description of the infrastructure and operations on site as well as the proposed changes thereto.

Chapter 6 - Project Motivation

This chapter provides a brief motivation for the proposed mine.

Chapter 7 - Public Consultation

This chapter details the process undertaken for public participation and provides a discussion on the issues raised and how these have been addressed.

Chapter 8 - Objectives

This chapter describes the environmental, legislative, EIA and EMP objectives of the project.

Chapter 9 - Assessment of impacts

This chapter assesses and rates the potential impacts on the environment.

Chapter 10 - Environmental Management Programme

Chapter 11 - Assumptions, uncertainties and gaps in knowledge

This chapter serves to indicate which gaps have been identified and how these should be addressed.

Chapter 12 - Environmental impact statement

The conclusion provides a brief discussion on the findings in the report and an opinion on whether this conversion should be approved or rejected.

Appendices

3. BASELINE ENVIRONMENTAL DESCRIPTION

3.1 Geology

The Transvaal Sequence in Griqualand West consists of a chemical sedimentary unit, the Ghaap Group, which is unconformably overlain by a mixed volcanic-chemical rock unit known as the Postmasburg Group (Figures 3.1 and 3.3). The Ghaap Group is subdivided from the base upwards into the following subgroups: the Schmidtsdrift Subgroup, the Campbellrand Subgroup (consisting of limestone and dolomite), the Asbesheuwels Subgroup and the Koegas Subgroup. The Postmasburg Group, on the other hand, consists of, from the base upwards: the Makganyene Diamictite, the Ongeluk Formation (which is andesitic lava), the Hotazel Formation (interbedded iron-formation and sedimentary manganese) and the Mooidraai Formation (limestone and dolomite). An angular unconformity by red beds of the Palaeophytic Olifantshoek Group which builds the Korannaberg fold belt along the western margin of the Kaapvaal Craton overlies the Transvaal Sequence (Beukes, 1986:819).

According to Beukes (1986:822) the manganese deposits of the area are related to the post-depositional history of the Transvaal Sequence, i.e. the period of weathering and erosion that preceded the deposition of both the Gamagara and Mapedi formations of the Olifantshoek Group (Beukes, 1986:822).

In the Maremane dome (Figures 3.2 and 3.3) - which is defined by carbonate rocks of the Campbellrand Subgroup and iron-formation of the Asbesheuwels Subgroup of the Transvaal Sequence dipping gently at less than 10° in an arc to the north, east and south (Van Schalkwyk & Beukes, 1986:931) - a palaeokarst erosion surface developed on the Campbellrand carbonate rocks, while resistant Kuruman Iron-formation slumped into palaeosinkholes before deposition of the Gamagara Formation. Wolhaarkop Breccia, which is a siliceous slump breccia, developed at the base of this slumped iron-formation. The latter formation is referred to as the Manganore Iron-formation, which distinguishes it from undisturbed Kuruman Iron-formation (Beukes, 1986:822). In the core of the Maremane dome, where the unconformity between the Transvaal and Gamagara sequences cuts across manganiferous dolomite of the Reivilo Formation, manganese wad, which later recrystallized to form the manganese deposits of the area, accumulated in palaeosinkholes (Beukes, 1986:822). Grobbelaar and Beukes (1986:957) confirm that the manganese deposits of the Sishen-Postmasburg area (within which the study area is located) are related to the unconformity between the Campbellrand Subgroup of the Ghaap Group and the Gamagara Formation in the Maremane dome.

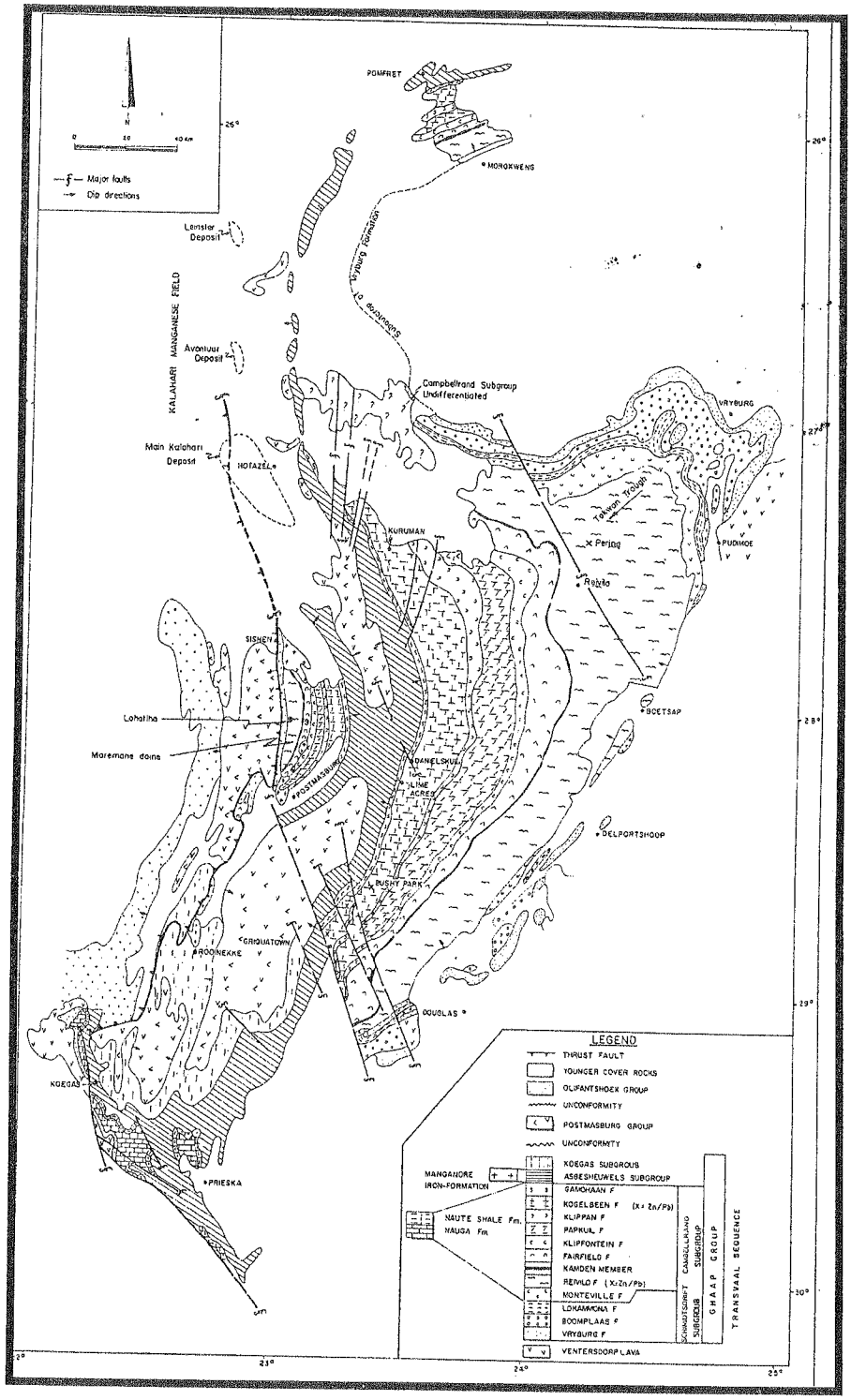


Figure 3-1: Geological map of the Transvaal Sequence in Griqualand West showing the distribution of major rock stratigraphic units and ore deposits [from Beukes (1986:820)].

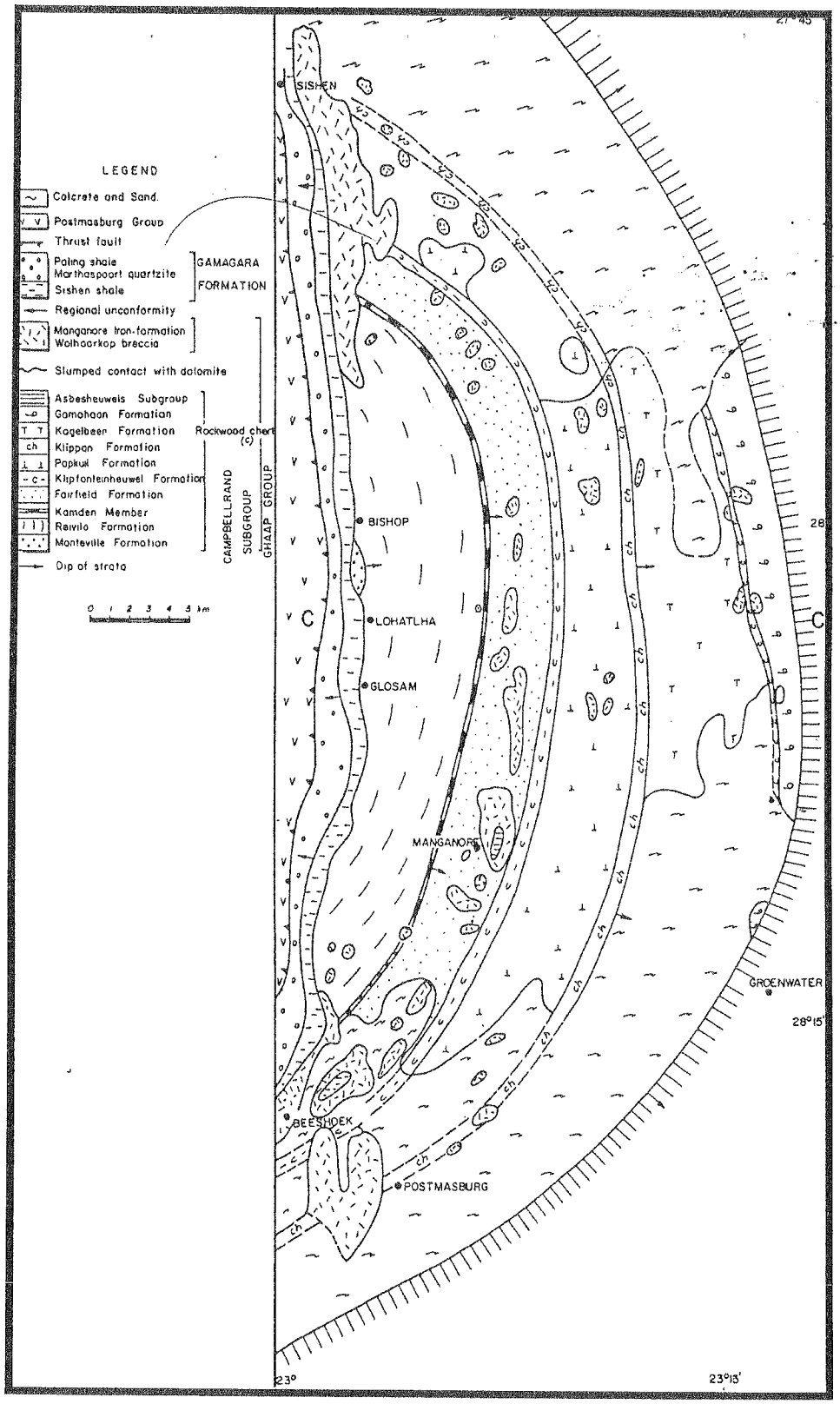


Figure 3-2: The Maremane dome [from Beukes (1986:823)].

Figure 3-3: Geology map of the study area

According to Casteel (2005) the area between Black Rock in the north (approximately 700 km southwest of Johannesburg) and Postmasburg (located approximately 160 km to the south) is a mineralization epicentre in South Africa. The manganese deposits of the area belong to the bixbyite-rich Western Manganese Belt of the Postmasburg manganese field (Grobbelaar & Beukes, 1986:957). The reserves of this belt are estimated at approximately 15 Mt with a manganese content of between 28 and 50 percent (Grobbelaar & Beukes, 1986:961).

3.2 Climate

Weather data used in this section was obtained from the South African Weather Service[1]. Data from the Postmasburg Weather Station No. 03211107 (Latitude: 28°35'S; Longitude: 23°08'E; Altitude: 1321 m above sea level) for the period 1993 to 2008 was used throughout.

3.2.1 Regional climate

The study area is situated in an arid to semi-arid region, receiving on average 298.93 mm of precipitation annually.

Rainfall in this region occurs largely in the form of showers and thunderstorms in the summer months of October to March (Van Rooyen 1971; Van der Merwe 1973), with the peak of the rainy season normally reached in February and March (Van Rooyen 1971).

Summers in this region are very hot with temperatures of up to 41°C in some places (Whitelaw 1998), while winters are cool to cold (Van der Merwe 1973).

3.2.2 Average monthly and annual rainfall

The average annual rainfall for the Postmasburg area is 298,93 mm.annum^{-1}, verifying that this area is located in a semi-arid region.

From Figure 6 it is clear that the peak of the rainy season in the Postmasburg area is reached in January (with an average rainfall of 47.79 mm), February (with an average rainfall of 45.91 mm) and March (with an average rainfall of 45.70 mm).

3.2.3 Maximum rainfall intensities

The highest maximum rainfall intensity over a 24 h period in the Postmasburg area between 1993 and 2008 was measured in February 2000, with ombrometers measuring a total of 57.60 mm in one day (highlighted in black in Table 1).

3.2.4 Average monthly maximum and minimum temperatures

It is clear from the data recorded in Figure 3.5 that December and January are the hottest months of the year in the Postmasburg area. Average monthly maximum temperatures of 31.77°C and 31.99 °C are recorded for January and December, respectively (Figure 3.5).

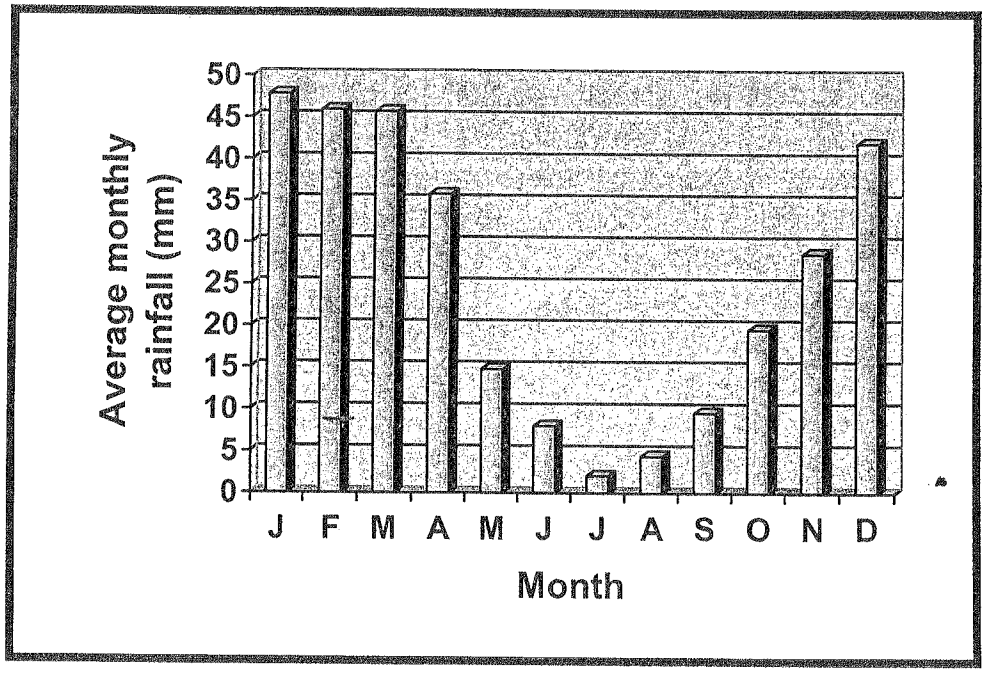


Figure 3-4: Average monthly rainfall for the Postmasburg area (Postmasburg Station No. 03211107: Latitude: 28°35'S; Longitude: 23°08'E; Altitude: 1321 m above sea level).

[1] South African Weather Service. ✉: Private Bag X097, Pretoria, 0001.

Table 3-1: Maximum rainfall intensities over a 24 h period for the Postmasburg area (Postmasburg Station No. 03211107: Latitude: 28°35'S; Longitude: 23°08'E; Altitude: 1321 m above sea level).

Month	Maximum rainfall over a 24 h period (mm)	Year in which maximum rainfall over a 24 h period occurred
January	52.60	1997
February	57.60	2000
March	52.80	2001
April	49.20	2001
May	35.20	1999
June	38.00	2008
July	6.00	2006
August	18.80	2002
September	30.80	2000
October	22.60	1997
November	34.80	1996
December	55.20	1999

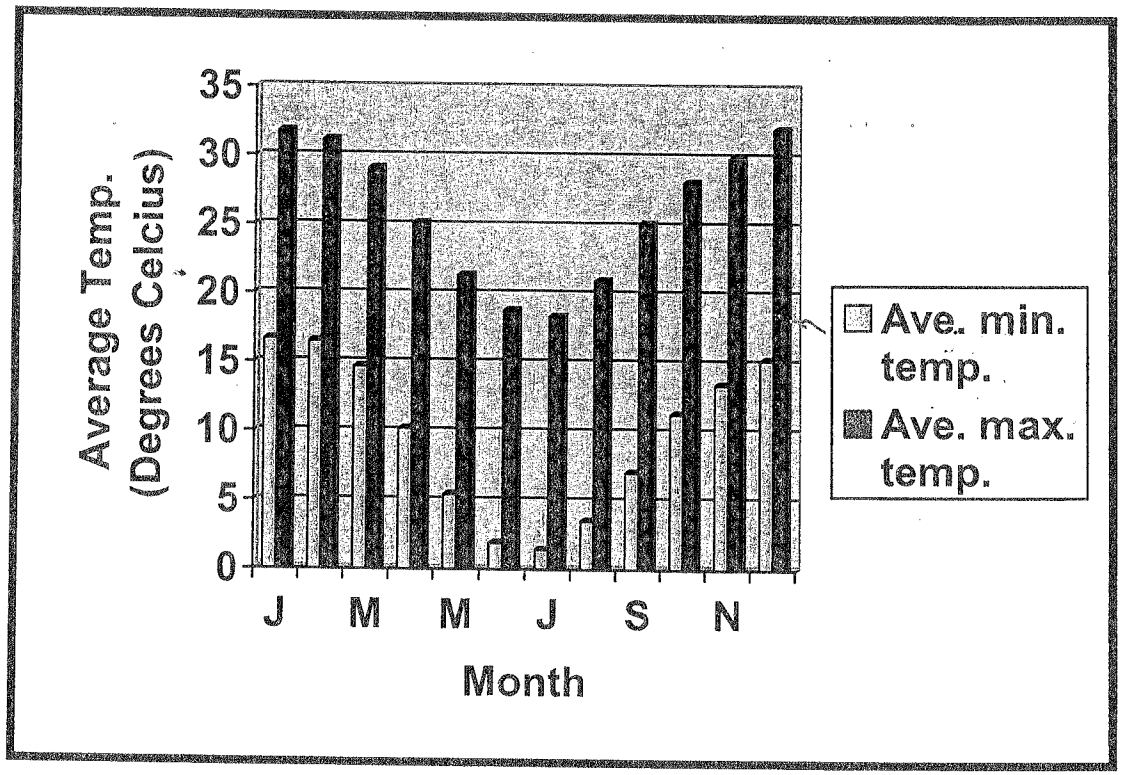


Figure 3-5: Average monthly maximum and minimum temperatures for the Postmasburg area (Postmasburg Station No. 03211107: Latitude: 28°35'S; Longitude: 23°08'E; Altitude: 1321 m above sea level).

3.2.5 Average wind speed and -direction

It is clear from the data presented in Table 3.2 that north-easterly winds (highlighted in black in Table 3.2) are prevalent in the Postmasburg area.

3.2.6 Average annual evaporation

Annual evaporation data for three Northern Cape locations are given in Table 3.3. No figures are currently available for Postmasburg.

3.2.7 Incidence of extreme weather conditions

3.2.7.1 Frost

Frost in the Northern Cape region occurs in the colder months of the year, namely May to September (Van Rooyen 1971; Van der Merwe 1973). Severe frost development can be expected in extreme minimum temperatures of up to -8°C reached on some winter nights.

Frost development may be both more common and severe in low-lying areas (Van Rooyen 1971).

3.2.7.2 Hail

Hail often accompanies early summer thunderstorms in this region. These hailstorms can be severe and cause much damage, but is often limited to small areas (Van Rooyen 1971).

3.2.7.3 Wind

Strong winds seldom occur in the region. In 1959 a storm of hurricane force did, however, cause extensive damage in the Prieska area (Van Rooyen 1971).

3.2.7.4 Droughts

Periodic droughts, with intensities ranging from mild to severe, commonly occur in the Northern Cape (Van Rooyen 1971). Dust storms may occur in times of drought.

Table 3-2: The percentage frequency (%) of winds from every wind direction for the Postmasburg area (Postmasburg Station No. 03211107: Latitude: 28°35'S; Longitude: 23°08'E; Altitude: 1321 m above sea level).

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
J	10	8	12	7	5	3	52	2	4	6	7	6	6	4	5	6
F	9	9	15	9	5	3	2	2	4	5	5	4	4	3	4	6
M	9	8	18	10	5	3	2	2	3	4	5	4	4	4	6	7
A	10	7	22	11	4	2	1	1	3	3	4	3	4	4	5	7
M	10	6	25	15	3	2	1	1	2	3	4	3	4	4	4	6
J	11	7	27	15	2	1	1	2	2	4	4	2	3	3	5	6
J	11	7	27	15	3	2	2	1	2	3	3	3	3	3	5	7
A	12	6	22	12	3	2	2	2	3	5	6	4	5	3	5	6
S	9	5	18	10	3	2	2	2	4	6	7	5	5	5	5	6
O	10	6	11	8	4	3	2	2	5	7	8	5	6	4	5	7
N	11	8	10	5	3	3	3	2	4	6	9	8	7	4	5	5
D	9	6	10	6	4	2	2	2	4	6	8	8	8	5	5	6

Table 3-3: Average annual evaporation for three Northern Cape stations (from Van Rooyen 1971).

Station	Average annual evaporation ($mm.\ annum^{-1}$)
Kalkfontein Dam	2 130
Kimberley	2 200
Prieska	2 500

3.3 Topography

Van Rooyen and Bredenkamp (1998:35) describe the general topography of the Kalahari Plains Thorn Bushveld Vegetation Type, in which the study area is located, as "*undulating to flat sandy plains, at 1000 m altitude*".

It is, however, evident from Figure 2 that the study area is located at altitudes that vary from 1320 m above sea level at the western boundary thereof, to 1360 m above sea level in the eastern parts thereof. In the southern corner of the property, i.e. the dumps area, the elevation increases from 1380 m above sea level to 1460 m above sea level. The topography of the study area can therefore be described as a gently undulating sandy plain, with a relatively sharp increase in elevation in the southern dumps area.

3.4 Soils

3.4.1 Soil types

Van Rooyen and Bredenkamp (1998:35) describe the soils of the study area as "*deep sandy to loamy sands of aeolian origin*".

3.5 Pre-mining land capability

Large parts of the study area have been disturbed by historical mining activities and were left un-rehabilitated.

Surrounding properties situated within the same vegetation type are mostly used for mining and livestock farming purposes.

3.6 Land use

3.6.1 Land use prior to mining

Refer to section 3.5

3.6.2 Historical agricultural activities

No record of historical agricultural activities in the study area exists.

3.6.3 Evidence of abuse

As was mentioned before, large parts of the study area have been disturbed by previous mining activities conducted in the area. Most of these areas were left in an un-rehabilitated state.

3.7 Natural Fauna

3.7.1 Common species

As a result of large scale habitat destruction that took place in the study area in the past, large numbers of wild animals are not known to frequent the area. The following animals do, however, occur in surrounding areas (Skinner & Smithers, 1990) and may therefore occasionally wander the study area: Reddish-grey Musk Shrew *Crocidura cyanea*, Domestic Mouse *Mus musculus*, Striped Field Mouse *Rhabdomys pumilio*, Cape Hare *Lepus capensis*, Scrub hare *Lepus saxatilis*, Springhare *Pedetes capensis*, Yellow mongoose *Cynictis penicillata*, Slender Mongoose *Galerella sanguinea*, Striped Polecat *Ictonyx striatus*, Small Spotted Genet *Genetta genetta*, Ground squirrel *Xerus inauris*, Cape Hedgehog *Atelerix frontalis*, Caracal *Caracal caracal*, African Wild Cat *Felis lybica*, Black-footed Cat *Felis*

nigripes, Bat-eared Fox *Otocyon megalotis*, Cape Fox *Vulpes chama*, Black-backed Jackal *Canis mesomelas*, Porcupine *Hystrix africaeaustralis*, Aardvark *Orycteropus afer*, Meerkat *Suricata suricatta*, Common Duiker *Sylvicapra grimmia*, Aardwolf *Proteles cristatus* and Pangolin *Manis temminckii*.

Of the above-listed animal species found in surrounding areas, the following species are protected in the Northern Cape Province under the Nature and Environmental Conservation Ordinance, 1974 (Ordinance No. 19 of 1974): Cape Hedgehog *A. frontalis*, Black-footed Cat *F. nigripes*, Cape Fox *V. chama*, Bat-eared Fox *O. megalotis* and Aardvark *O. afer*.

3.8 Natural land vegetation

Information supplied by Albie Götze and is attached as Appendix A of this report.

The study area, which is 1726ha in size, is situated approximately 32km north of Postmasburg on both sides of the R325 road to Kuruman in the Northern Cape Province. Floristically the study area is situated in the Kuruman Thornveld (SVk 9) and the Kuruman Mountain Bushveld (SVk 10) Vegetation Types as described by Mucina & Rutherford (2006).

The landscape of the Kuruman Thornveld (SVk 9) consists of flat rocky plains and some sloping hills which support a well developed, closed shrub layer dominated by *Acacia mellifera* and *Tarchonanthus camphoratus* and sometimes a well developed open tree layer dominated by *Acacia erioloba*. Soils in the area are mostly of the Hutton form and consist of windblown red sand, which vary in depth from shallow to deep (Mucina & Rutherford (2006). Some shallow, sandy Mispah soils were also observed. The Kuruman Mountain Bushveld (SVk 10) Vegetation Type occurs on rolling hills with generally gentle to moderate slopes and hill pediment areas with open shrubveld and a well developed grass layer. Soils are mostly shallow sandy Hutton and Mispah soils (Mucina & Rutherford (2006). Rainfall falls in summer and autumn with a mean annual precipitation of between 250mm and 500mm with very dry winters with frost (Mucina & Rutherford, 2006).

3.8.1 Conservation status

According to Mucina & Rutherford (2006) both the Kuruman Thornveld (SVk 9) and Kuruman Mountain Bushveld (SVk 10) Vegetation Types are classified as Least Threatened. No portions of these two vegetation types are statutorily conserved and both are very little transformed in general. Six endemic taxa occur in the Kuruman Thornveld (SVk 9), of which one is endemic to this vegetation type, two are Kalahari endemics and three are endemic

to Griqualand West. Six Griqualand West endemics and one species endemic to the vegetation type occur in the Kuruman Mountain Bushveld (SVk 10) Vegetation Type (Mucina & Rutherford, 2006).

3.8.2 Plant diversity

A total of 224 plant species were identified in the study area during the time of the study, which indicates moderate to high species diversity. The woody layer (trees & shrubs) is represented by 29 species. The herbaceous layer is made up of 45 grass species and 150 herbaceous shrubs, dwarf shrubs, forbs/herbs and sedges. 92% (205 of 224) of the identified plant species are indigenous to South Africa.

3.8.3 Description of vegetation

3.8.3.1 Vegetation Unit 1: The Putterlickia saxatilis - Cymbopogon pospischilii *Open Mountain Shrubland*

This vegetation unit (Figure 3.6) is situated on mountainous terrain of the Kuruman Mountain Bushveld (SVk 10) Vegetation Type (Mucina & Rutherford, 2006) in the study area on shallow sandy to loamy soils. The vegetation of this unit is dominated by shrubs and grasses with some low trees that occur scattered throughout the unit. The general estimated veld condition is moderate to good, with the main cause of degradation being prospecting and mining for iron and manganese ore in the past as well as some signs of heavy grazing in the past. Overall, however, the vegetation of this unit is in a good state. With 132 plant species recorded, floristically the *Putterlickia saxatilis - Cymbopogon pospischilii* Open Mountain Shrubland Vegetation Unit is the most diverse of the vegetation units in the study area. 37 of the 132 species were recorded only in this vegetation unit in the study area. The protected tree species *Boscia albitrunca* (DWAF, 2004 & 2007) was abundant in this vegetation unit, but mostly in the form of low growing shrubs that are kept that way by browsing animals. Four endemic species to Griqualand West were also recorded. They are the woody shrubs *Putterlickia saxatilis* and *Lebeckia macrantha,* the herb *Blepharis marginata* and the grass species *Digitaria polyphylla.*

The dominant woody species in this vegetation unit are *Putterlickia saxatilis, Rhus ciliata, R. burchellii, Tarchonanthus camphoratus, Lebeckia macrantha* and *Euclea undulata.* Dominant grass species are *Cymbopogon pospischilii, Aristida scabrivalvis, Eragrostis curvula, Sporobolus fimbriatus, Eragrostis nindensis* and *Brachiaria nigropedata.* The most prominent herbs include *Chrysocoma ciliata, Chascanum pinnatifidum* var. *pinnatifidum, Peliostomum leucorrhizum, Sutera halimifolia, Hermannia bryoniifolia, Anthospermum rigidum* subsp. *pumilum* and the shrub *Stachys burchelliana.* A variation of this vegetation unit (Figure 3.7) was observed in a grassy band on the northern side of the mountains on

the area west of the R325 road. In this area the prominent woody species are *Acacia mellifera, Rhus ciliata* and *Rhigozum trichotomum* shrubs, the grasses *Heteropogon contortus, Eragrostis nindensis, Enneapogon scoparius* and *Fingerhuthia africana*. The forbs that dominate this variation are *Melhania rehmannii, Evolvulus alsinoides* and *Corbichonia decumbens*.

Figure 3-6: The Putterlickia saxatilis - Cymbopogon pospischilii Open Mountain Shrubland.

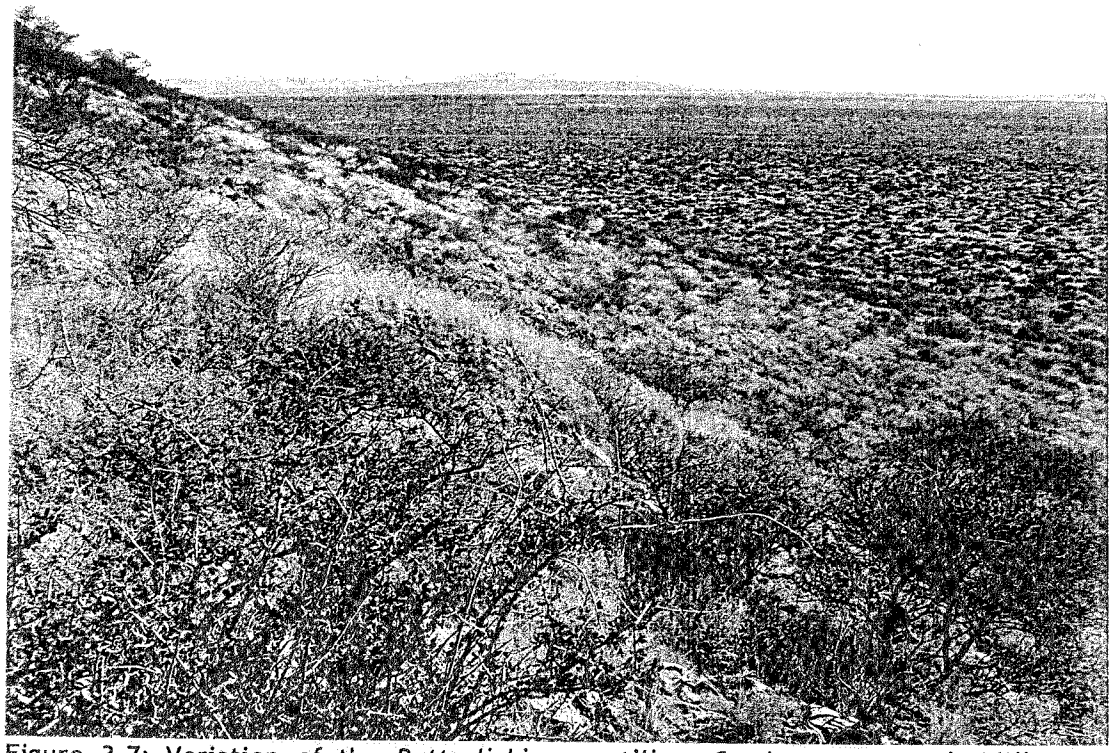


Figure 3-7: Variation of the *Putterlickia saxatilis* - *Cymbopogon pospischilii* Open Mountain Shrubland on northern slopes.

3.8.3.2 Vegetation Unit 2: The Acacia mellifera - Stipagrostis uniplumis Closed Shrubland

The *Acacia mellifera* - *Stipagrostis uniplumis* Closed Shrubland Vegetation Unit (Figure 3-8) is situated on moderately deep to shallow sandy, rocky soils. Topographically it is situated on the foot slopes of Vegetation Unit 1 and is dominated by woody shrubs. This vegetation unit is mostly situated in the Kuruman Thornveld (SVk 9) Vegetation Type (Mucina & Rutherford, 2006). In general this vegetation unit was observed to be slightly overgrazed and in some places heavily bush encroached by the woody shrubs *Acacia mellifera* and *Rhigozum trichotomum*. 127 plant species were recorded in this unit during the time of the study and 17 of those were only recorded in this vegetation unit in the study area. The protected tree species *Acacia erioloba* and *Boscia albitrunca* (DWAF, 2004 & 2007) occurs sparsely in this vegetation unit. The three Griqualand West endemics *Putterlickia saxatilis*, *Lebeckia macrantha*, and *Blepharis marginata* were also recorded.

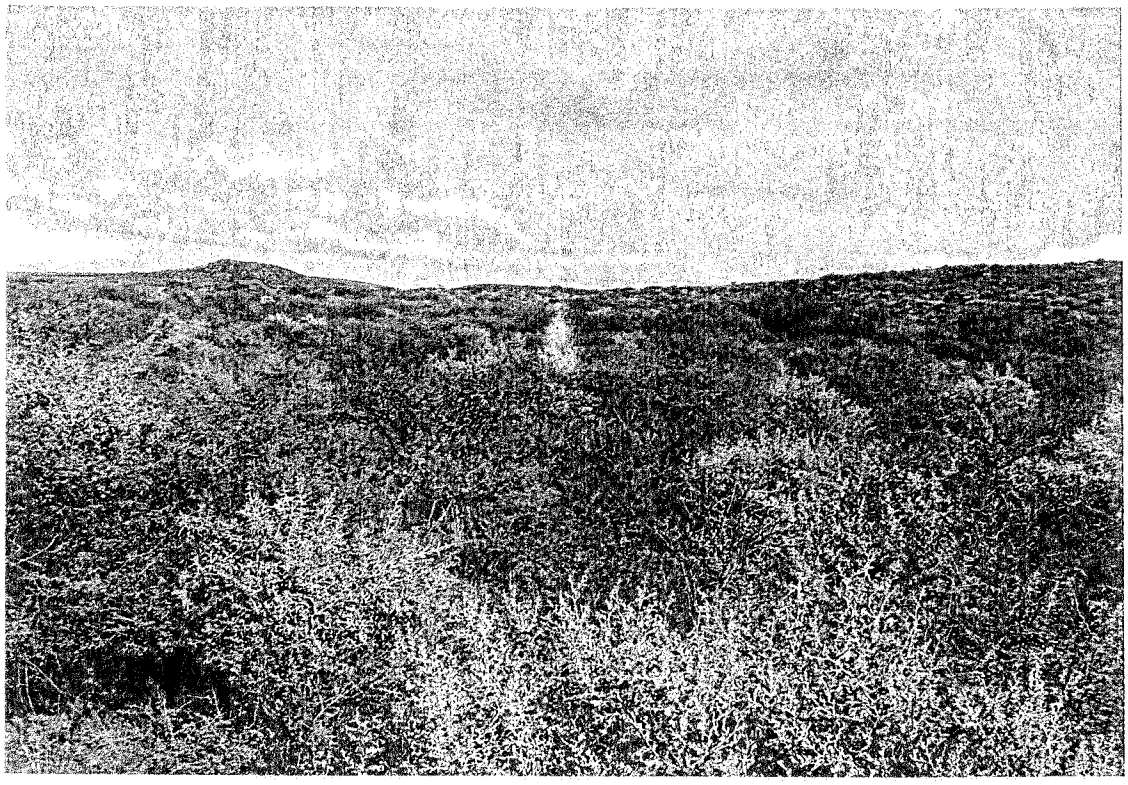


Figure 3-8: The Acacia mellifera - Stipagrostis uniplumis Closed Shrubland Vegetation Unit.

The woody layer is very well developed in this vegetation unit and is dominated by shrubs that include the species *Acacia mellifera, Tarchonanthus camphoratus, Rhus burchellii, Rhigozum trichotomum and Lycium cinereum*. The herbaceous layer is dominated by the grasses *Stipagrostis uniplumis, Eragrostis lehmanniana, Aristida congesta* and *Heteropogon contortus*, and the dwarf shrubs and herbs *Pteronia mucronata, Pentzia calcarea, Peliostomum leucorrhizum, Chrysocoma ciliata, Leucas capensis* and *Selago dinteri* subsp. *pseudodinteri*.

3.8.3.3 Vegetation Unit 3: The Rhus lancea - Oropetium capense Open Woodland

This vegetation unit (Figure 3-9) is situated in areas where water accumulates during wet periods. It forms part of the Kuruman Thornveld (SVk 9) Vegetation Type (Mucina & Rutherford, 2006) and occurs on shallow to moderately deep dolomitic and sometimes calcerous loamy soils. The vegetation of this unit is dominated by tree clumps and grasses and appears to generally be in a moderate to poor veld condition. Signs of heavy grazing in the past are clearly visible in some parts of this vegetation unit. With only 64 plant species recorded in this vegetation unit of which only four were only recorded in this vegetation unit in the study area, it is the least diverse vegetation unit in the study area.

The well developed woody layer is dominated by Rhus lancea, Diospyros lycioides, Ziziphus mucronata and Tarchonanthus camphoratus. The grass dominated herbaceous layer is dominated by the grasses Oropetium capense, Enneapogon desvauxii, Aristida adscensionis, Cynodon dactylon, Eragrostis lehmanniana, and Setaria verticillata. Dominant herbs in this vegetation unit are Selago densiflora, Geigeria burkei, Pentzia globosa and Chrysocoma ciliata.

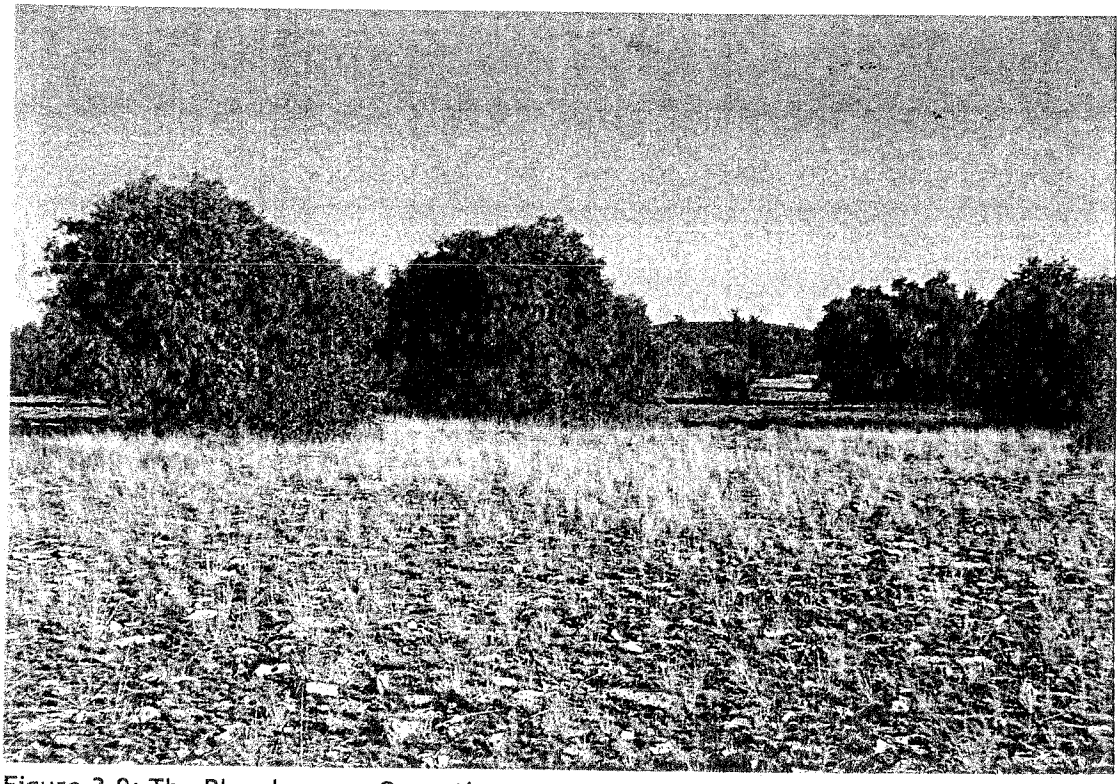


Figure 3-9: The Rhus lancea - Oropetium capense Open Woodland.

3.8.3.4 Vegetation Unit 4: The Tarchonanthus camphoratus - Eragrostis lehmanniana Open Shrubland

This open shrubland vegetation unit (Figure 3-10) is dominated by the shrub layer with trees scattered throughout the unit and is situated on shallow to deep sandy soils. Ecologically the Tarchonanthus camphoratus - Eragrostis lehmanniana Open Shrubland appears to be in a moderately good to good condition, with signs of degradation mainly in the form of disturbance due to prospecting and some heavy grazing in the past. Limited bush encroachment was also observed. 97 plant species were recorded of which 13 were recorded only in this vegetation unit in the study area. A number of specimens of the protected Acacia erioloba and Boscia albitrunca (DWAF, 2004 & 2007) were recorded in this vegetation unit.

The well developed woody layer is strongly dominated by Tarchonanthus camphoratus. Other woody species of importance in this vegetation unit are Euclea undulata, Rhus burchellii, R. ciliata, and Ziziphus mucronata. In the herbaceous layer the grass species

Eragrostis lehmanniana, Enneapogon scoparius and Aristida congesta are dominant together with the herbs Pentzia sphaerocephala, Chrysocoma ciliata, Selago densiflora, and Felicia muricata.

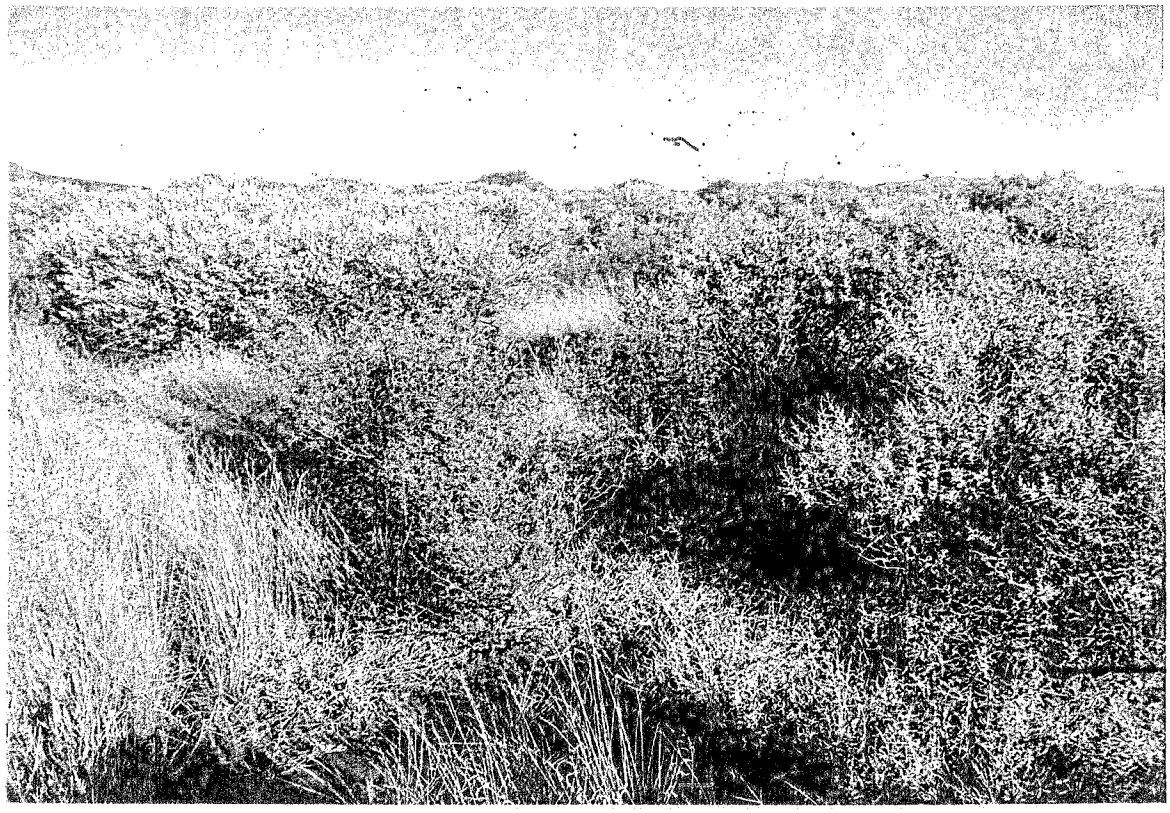


Figure 3-10: The Tarchonanthus camphoratus - Eragrostis lehmanniana Open Shrubland.

3.8.3.5 Vegetation Unit 5 : The vegetation of severely disturbed and degraded areas

This vegetation unit is situated on areas that were partially or totally destroyed as a result of prospecting; mining; ore processing (Figure 3-11) or other anthropogenic land uses and is still operational or un-rehabilitated. The vegetation occurring on these areas consists of a mixture of fragmented natural vegetation and pioneer vegetation in areas where the soil surface has been disturbed or totally stripped of natural vegetation (Figure 3-12). It also includes vegetation that has established on unrehabilitated mine dumps, processing areas, opencast mining areas, etc.

The pioneer vegetation that established in these disturbed and degraded areas include a number of alien plants. Most of them are annual species, but some perennial, declared weeds and invaders were also recorded. The dominant vegetation of these areas varies from area to area, but the most common plant species include the woody plants Tarchonanthus camphoratus, Rhus ciliata, Acacia mellifera, A. tortilis subsp. heteracantha, Ziziphus mucronata and the exotic Nicotiana glauca, as well as the grasses Aristida adscensionis, A. congesta, Chloris virgata, Cynodon dactylon, Eragrostis curvula, E. echinochloidea and Melinis repens. The indigenous herbs Dicoma capensis, Eriocephalus

ericoides, Laggera decurrens and the exotic herbs Alternanthera pungens, Chenopodium carinatum, Datura ferox, Salsola kali and Tagetes minuta are also abundant in these areas.

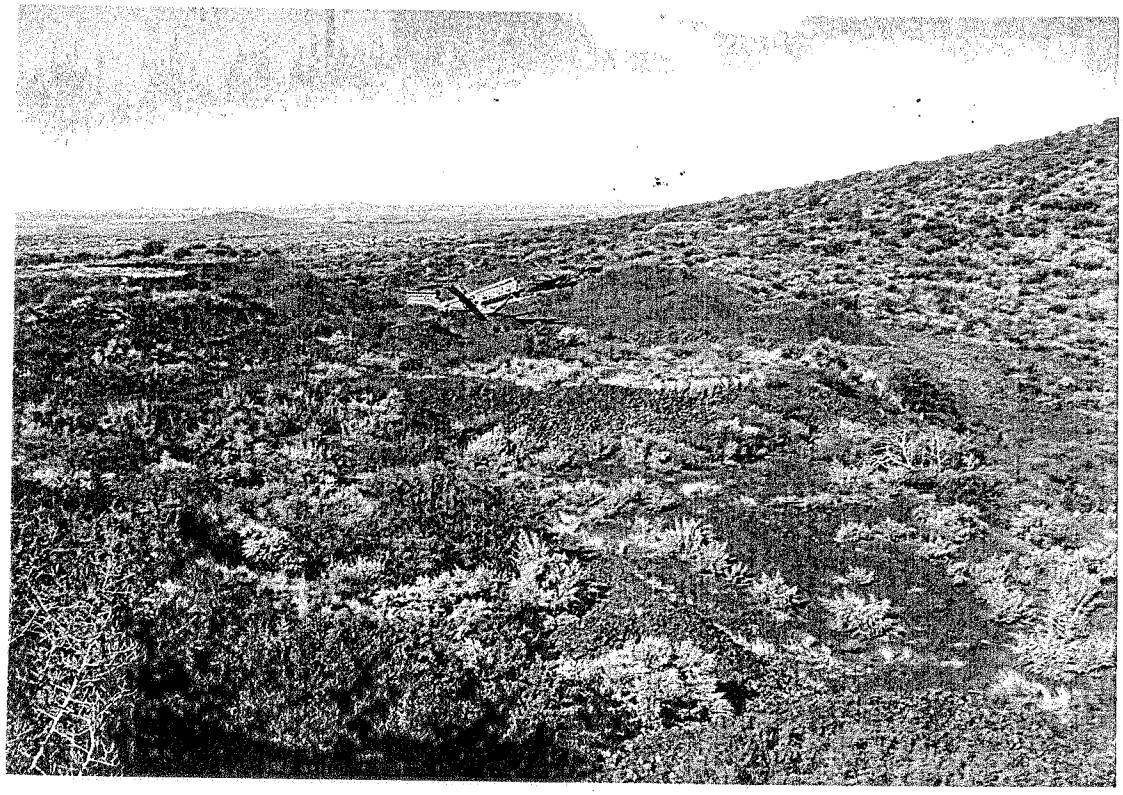


Figure 3-11: An existing opencast mining and processing area on Kareepan.

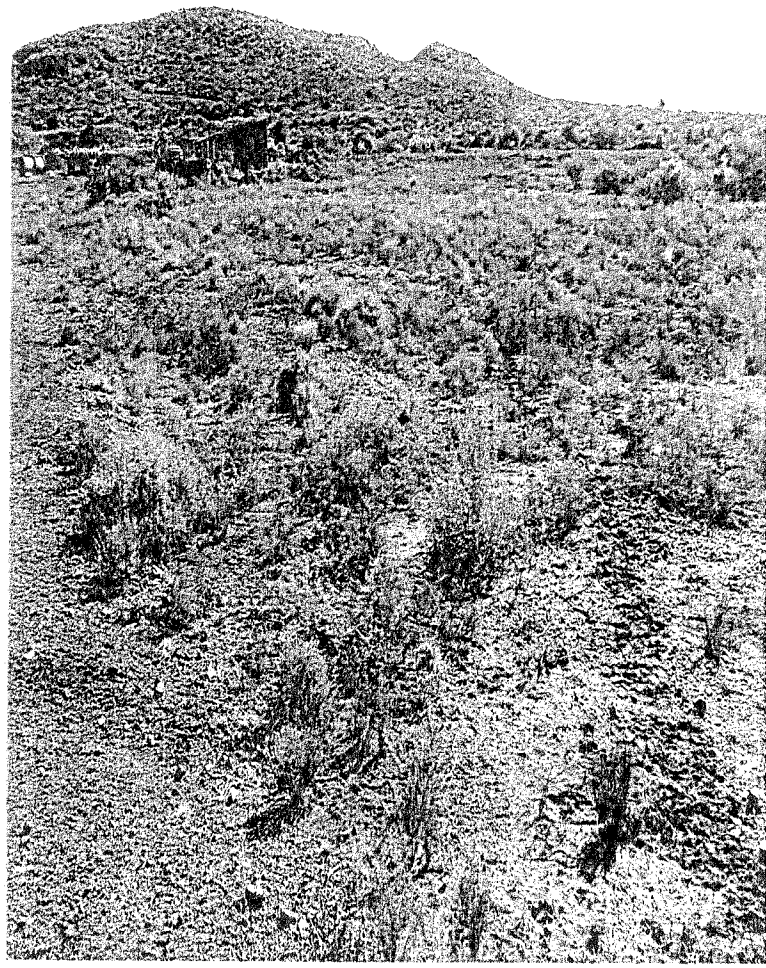


Figure 3-12: An area cleared of natural vegetation near an opencast mining area on Kareepan

3.9 Surface water

No sources of surface water are known to be located within the borders of the study area.

3.9.1 Water authority

The Northern Cape Province Department of Water Affairs and Forestry has authority over both the underground- and surface water resources of the province.

3.9.2 Wetlands

No wetlands are located within the boundaries of the study area.

3.10 Groundwater

By the time of submission the groundwater study was not finalized and will be submitted upon completion thereof.

3.11 Change of rivers

No change of rivers is planned as part of the proposed mining operation.

3.12 Air quality

A copy of the specialist report is attached as Appendix B to this report.

No long term weather dataset was available for the site in question so Postmasburg, Northern Cape was selected as an acceptable proxy in consultation with the South African Weather services (SAWS).

Dust emissions are a function of the makeup of the exposed material (particularly silt and small particle content), wind and moisture. Conditions of fine, dry, exposed material in windy weather will result in the greatest emissions. Thus, in analysing potential dust from a source such as the Kareepan mine, it is these factors on which the focus lies.

3.12.1 Precipitation

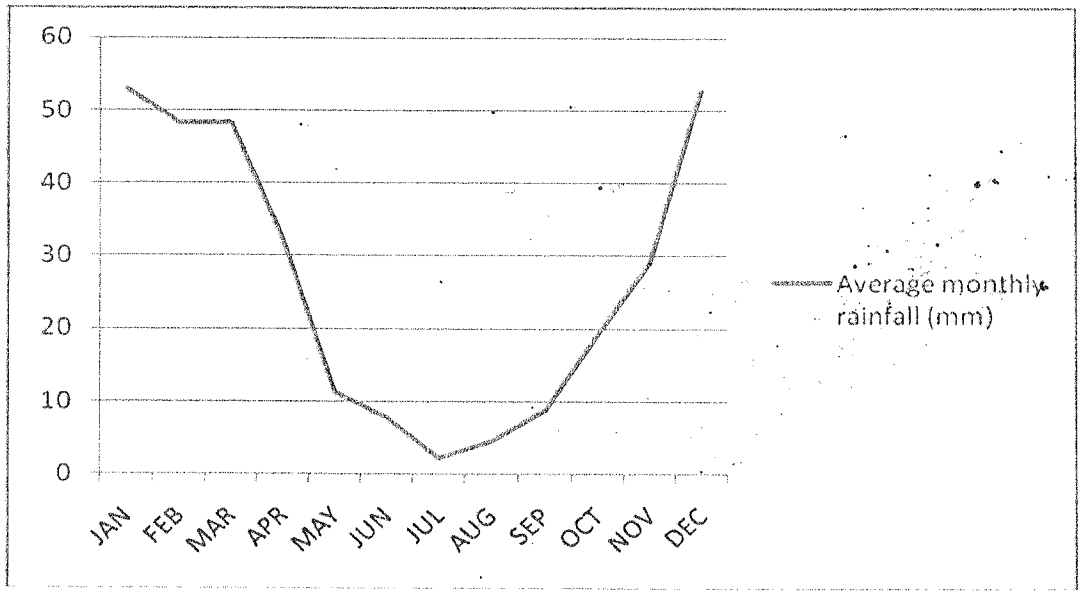


Figure 3-13 Average monthly rainfall - Postmasburg, Northern Cape (SAWS, 1993 - 2009)

The mine is set on the arid flats of the Northern Cape. It is in South Africa's summer rainfall region with an annual average rainfall of under 400mm per year. Rain peaks mid-season, in December and January, while the winter months are characterized by a long, very dry period. Rain is generally delivered in short duration convective thunderstorms.

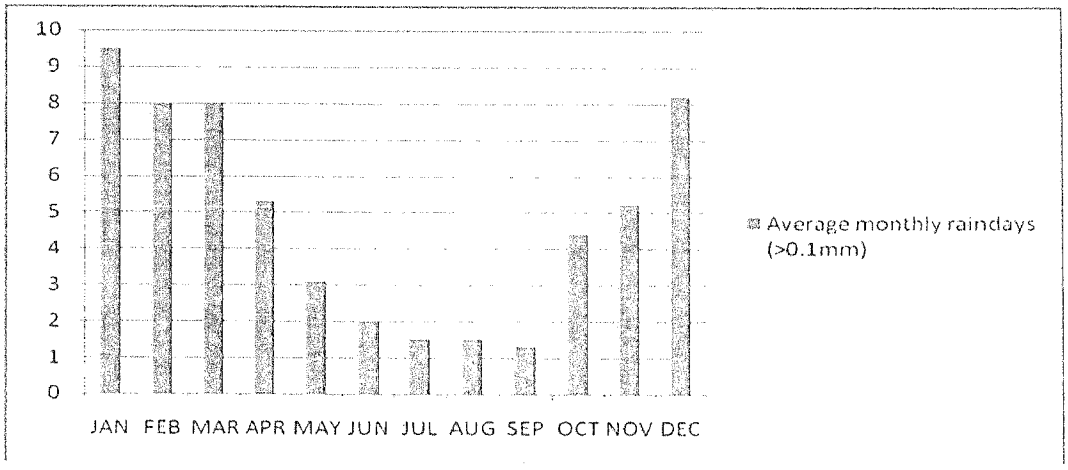


Figure 3-14: Average monthly rain days > 0.1mm - Postmasburg, Northern Cape (SAWS, 1993-2009)

Even the addition of a small amount of moisture can have a dramatic effect on the reduction of potential dust emissions. Similarly, a long spell without rain will necessitate intervention in the form of dust control measures in order to manage impacts on the surrounding environment. These will be particularly necessary during the months from April

to October but the very hot dry climate will likely necessitate almost permanent dust mitigation.

3.12.2 Temperature

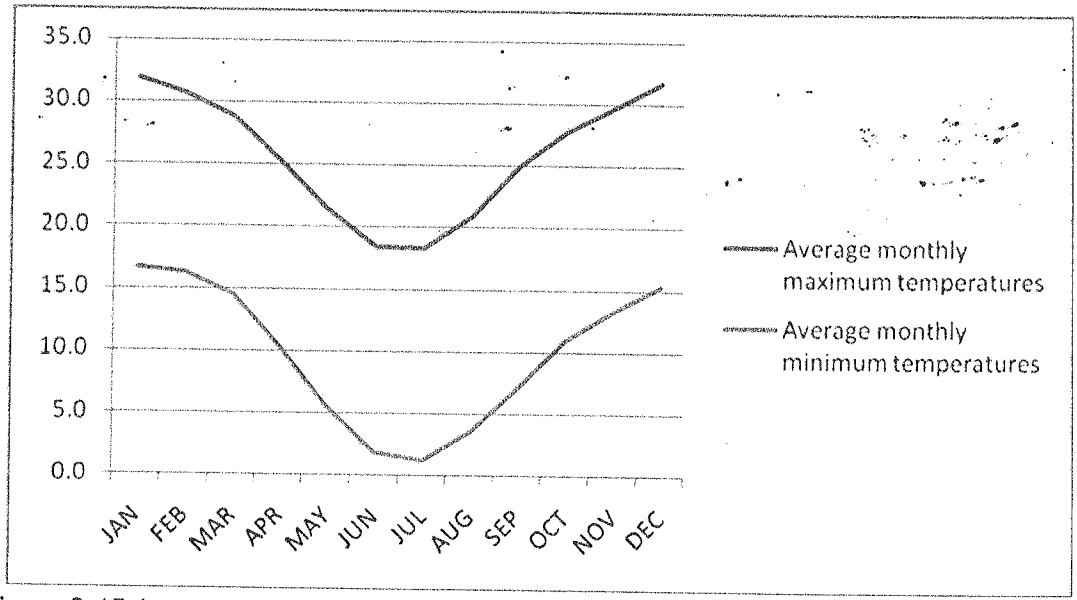


Figure 3-15 Average monthly temperatures - Postmasburg, Northern Cape (SAWS, 1993-2009)

The warmest period is December / January, when maximum temperatures averaging above 30 degrees centigrade while July is the coldest with daytime temperatures averaging 18.3 degrees and overnight temperatures frequently dropping below freezing. The winter period is also very dry with little or no rainfall and relative humidity dropping below the 40% mark.

3.12.3 Wind

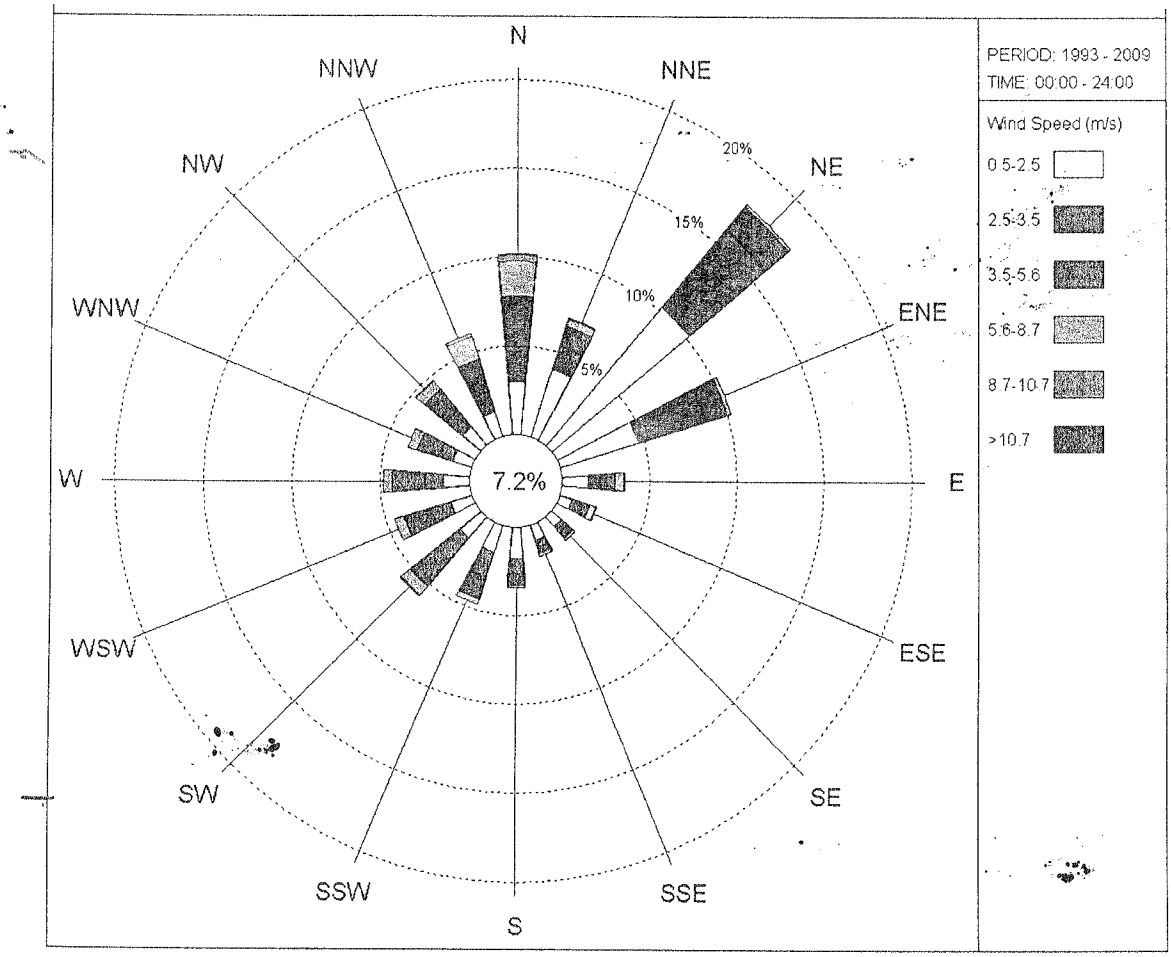


Figure 3-16 Annual average wind speed and direction - Postmasburg, Northern Cape (SAWS, 1993 - 2009)

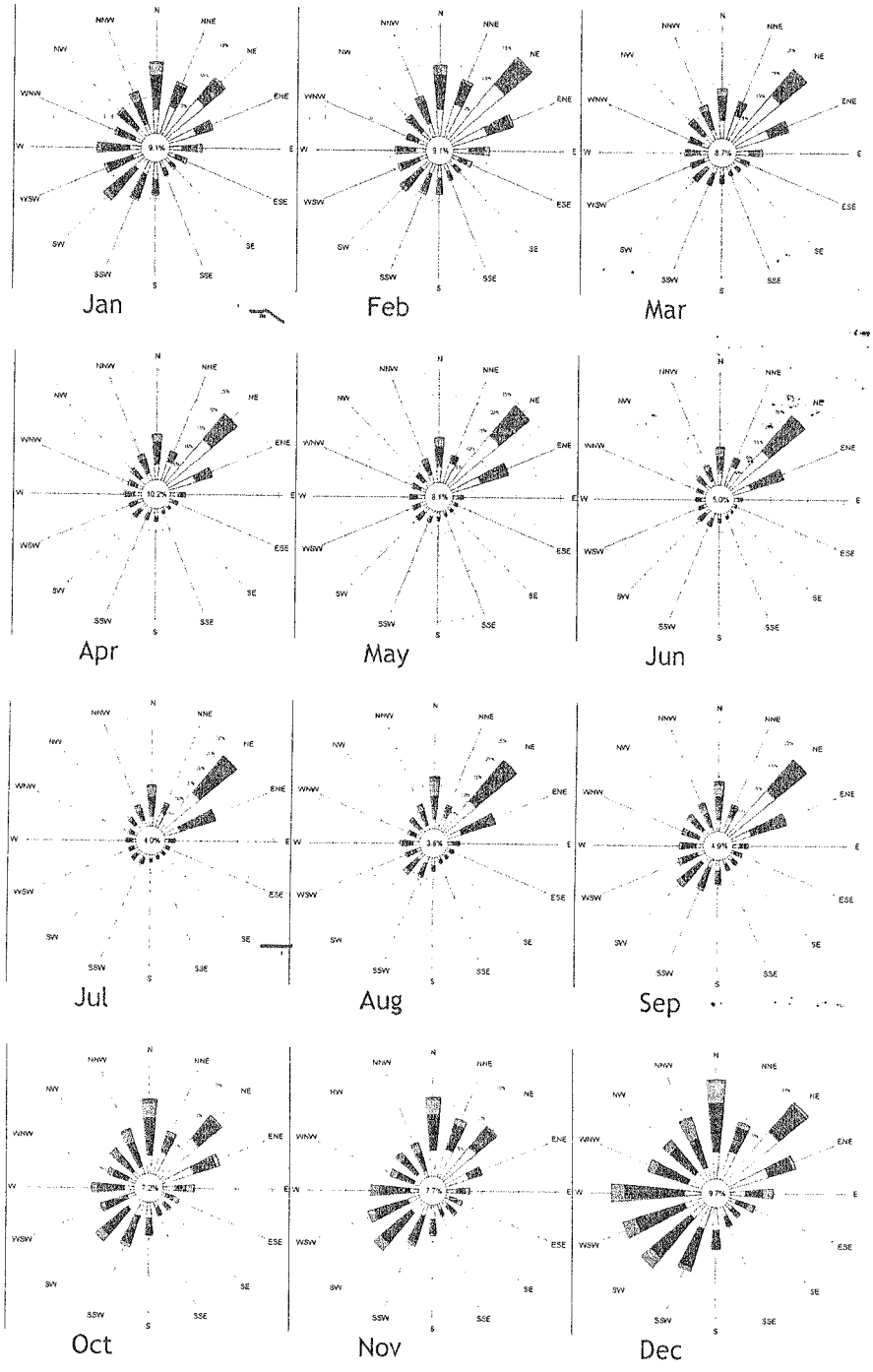


Figure 3-17 Monthly average wind speed and direction - Postmasburg, Northern Cape (SAWS, 1993 - 2009)

Winds are predominantly northeasterly with a strengthening westerly component in summer. Strongest wind speeds are recorded in winter, and are associated with frontal southwesterlies. More than a third of the data shows periods of calm (wind <0.5 $m.s^{-1}$).

3.13 Noise

3.13.1 Existing sources

A number of smaller mining operations are located in the vicinity of the proposed mining area. Some degree of noise pollution is assumed to be caused by all of these operations.

3.13.2 New sources

The noise associated with the proposed mining operation will be that caused by the operation of mining vehicles and -machinery and the processes associated therewith.

3.14 Sensitive landscapes

From the following list of possible sensitive areas, the sensitive areas known to be present in the study area are highlighted:

- Limited development areas [Section 23 of the Environment Conservation Act, 1989 (Act No. 73 of 1989)];
- Protected natural environments and national heritage sites;
- National, provincial, municipal and private nature reserves;
- Conservation areas and sites of conservation significance;
- National monuments and gardens of remembrance;
- **Archaeological and palaeontological sites;**
- **Graves and burial sites;**
- Lake areas, offshore islands and the admiralty reserve; and
- Demarcated areas or features, which includes any of the following which have been demarcated by a central, regional or local authority:
    - Estuaries, lagoons, wetlands and lakes;
    - Streams and river channels and their banks;
    - Dunes and beaches;
    - Caves and sites of geological significance;
    - Battle and burial sites;
    - Habitat and/or breeding sites of Red Data Book species;
    - Areas or sites of outstanding natural beauty;
    - Areas or sites of specific scientific interest;
    - Areas or sites of special social, cultural or historical interest;

- Mountain catchment areas; and
- Areas with eco-tourism potential.

3.15 Visual aspects

3.15.1 Visibility of the mine from existing roads

Mining activities associated with the proposed operation will be visible from the R325 between Postmasburg and Kathu.

3.15.2 Visibility of the mine from residential areas

The mining activities of the applicant are not anticipated to be visible from any residential areas. Postmasburg, the town located closest to the study area, is located approximately 6 km from the study area.

3.15.3 Visibility of dust being generated

It is anticipated that dust to be emitted by the activities constituting the proposed mining operation will be visible from the R325, as well as neighbouring farms.

3.15.4 Visibility of the mine from tourist routes

No major tourist routes are located in the vicinity of the proposed mining area.

3.16 Socio-economic structure of the region

The study area is located within the boundaries of the Tsantsabane Local Municipality (Fig 3-18 A), which is located within the boundaries of the Siyanda District Municipality (Fig 3-18 B).

Information detailed in the following sections applies to the Tsantsabane Local Municipality (Fig 3-13). All information supplied was sourced from Census 2001: Key Municipal Data (2004) and reflects the results of the 2001 South African census.

3.16.1 Housing

As is evident from Figure 3-19, the majority of households resident in the TLM (77.4%) resides in brick structures on separate stands or yards. A total of 12.0% of households resident in the TLM live in informal dwellings or shacks that are not located in another party's backyard. The remaining 10.6% of households of the TLM reside in traditional dwellings; flats, town- or cluster houses; houses/rooms or shacks located in backyards; rooms or flatlets on shared properties; caravans; and tents.

3.16.2 Sanitation

Figure 3-20 indicates that the largest portion of households in the TLM (67.2%) have access to flush toilets that are connected to a sewerage system. Only 8.4% of households resident in the TLM still make use of the bucket toilet system, while 9.2% of households do not have access to any sanitation facilities at all. The remaining 28.3% of households make use of flush toilets connected to a septic tank; chemical toilets or pit latrines.

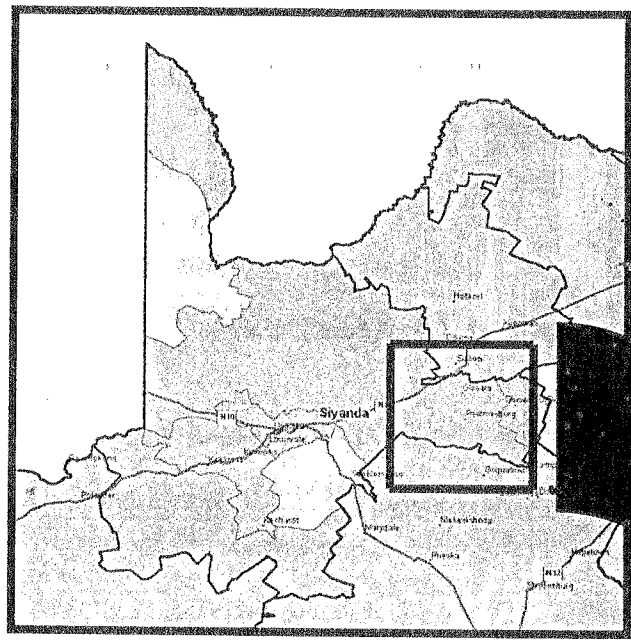
3.16.3 Electricity

It is evident from Figure 3-21 that more than half of the households (84.8%) resident in the TLM use electricity as main source of fuel for lighting purposes. A further 56.1% of households resident in the area use electricity as main fuel source for heating purposes, while 66.4% of households use electricity as main fuel source for cooking purposes.

3.16.4 Access to water

Figure 3-22 clearly indicates that the largest portion of households resident in the TLM (84.6%) has access to piped water within their dwelling or yard. A further 12.7% of households have access to piped water obtainable from a source located 200 m or further away. The remainder of households of the TLM (2.7%) makes use of borehole water; rainwater tanks; dams or pools of stagnant water; rivers or streams; water vendors; or other alternative sources of water.

A



B

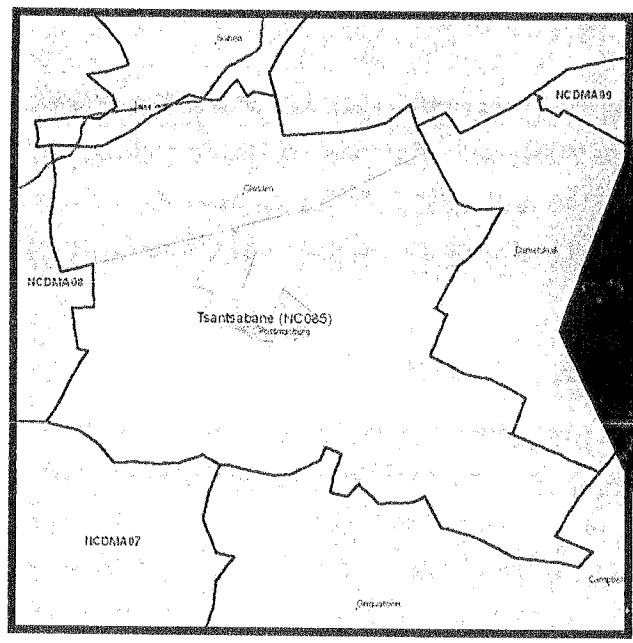


Figure 3-18 A and B: The geographical setting of the Siyanda District Municipality (A) and the Tsantsabane Local Municipality (B).

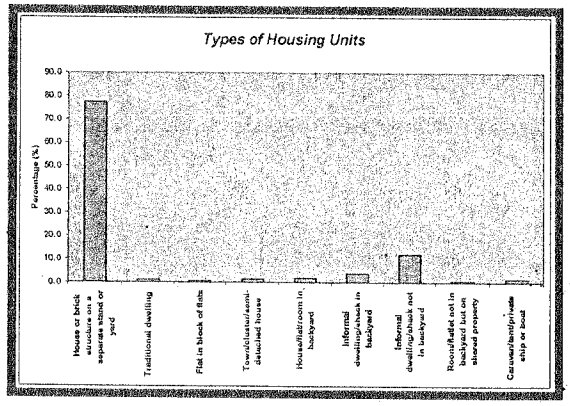


Figure 3-19: Different types of housing units in the Tsantsabane Local Municipality.

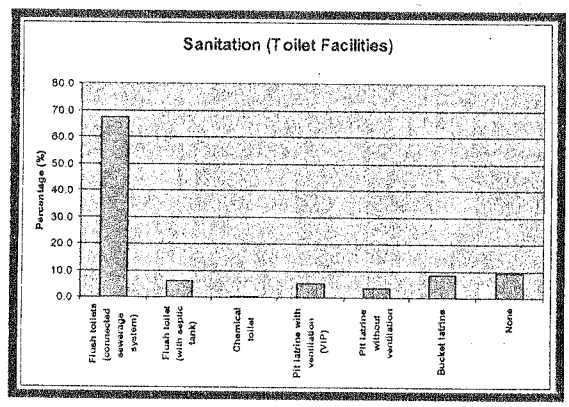


Figure 3-20:. The availability of different sanitation facilities to households resident in the Tsantsabane Local Municipality.

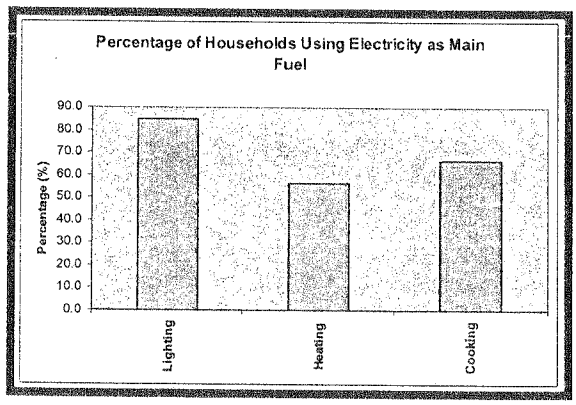


Figure 3-21: Percentage of households resident in the Tsantsabane Local Municipality using electricity as main source of fuel for lighting, heating and cooking purposes.

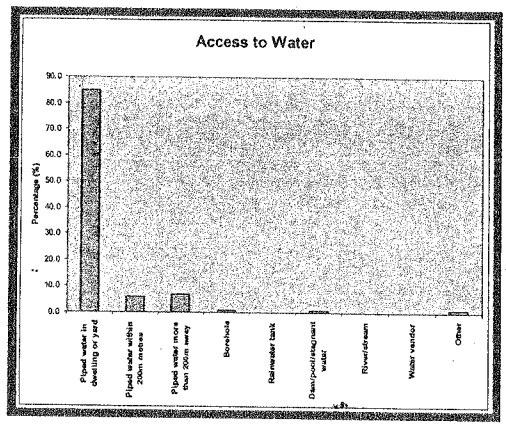


Figure 3-22: Percentage of households resident in the Tsantsabane Local Municipality with access to water.

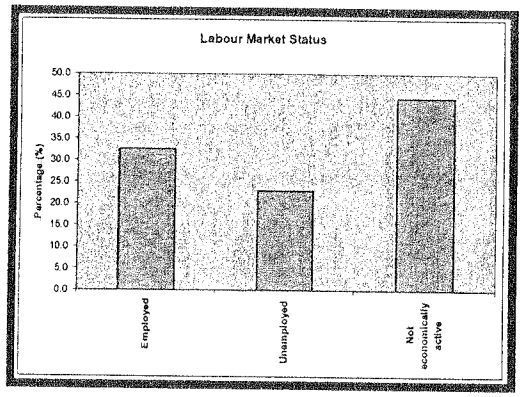


Figure 3-23: Labour market status of the Tsantsabane Local Municipality.

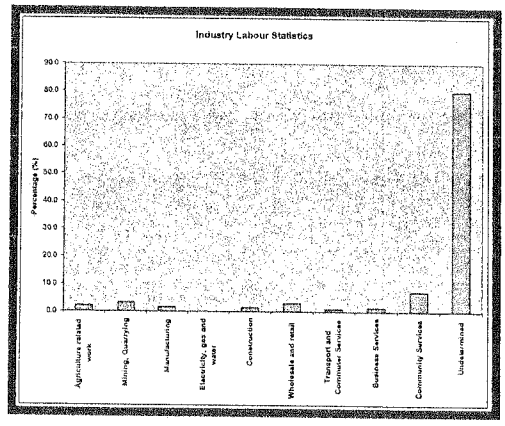


Figure 3-24: Industry labour statistics of the Tsantsabane Local Municipality.

4.17.5 Labour market status

It is evident from Fig 3-23 that only 32.6% of persons aged 15 to 65 years residing in the TLM are employed. 23.0% of persons in this age group are unemployed, while the remaining 44.5% is economically inactive.

3.16.5 Industry labour statistics

Fig 3-24 indicates that the largest portion of the labour force of the TLM works for an undetermined industry. Relatively large portions of the labour force are also employed by the community service, agriculture and mining sectors. The remaining portion of the labour force of the TLM is employed by the following sectors: manufacturing; electricity, gas and water; construction; wholesale & retail; transport and commuter services; and business services.

3.16.6 Social infrastructure

No social infrastructure (e.g. clinics, a shop, etc.) exists on the farms Kareepan No. 450 and Pensfontein No. 449. As was mentioned a total of 10 schools (three secondary and seven primary schools); seven medical facilities (including one hospital, two satellite clinics, three clinics and one mobile clinic); and one police station are situated within the borders of the Tsantsabane Local Municipality.

3.16.7 Main challenges facing the Tsantsabane Local Municipality

In light of the sections above, it is evident that one of the main challenges that the TLM is faced with, is unemployment.

3.17 Areas of cultural, historical or archaeological interest

Information supplied by Anton von Vollenhoven and is attached as Appendix C of this report.

Large portions of the area have been extensively disturbed through recent historical and current opencast mining activities (prospecting). An existing railway line, as well as the R325 road and a number of haul roads also cut through the area. Surrounding properties situated within the same vegetation type are mostly used for mining and livestock farming purposes. The survey concentrated to a large degree on the relatively undisturbed areas.

3.17.1 Stone Age

The Stone Age is the period in human history when lithic material was mainly used to produce tools (Coertze & Coertze 1996: 293). In South Africa the Stone Age can be divided in three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. The division for the Stone Age according to Korsman & Meyer (1999: 93-94) is as follows:

Early Stone Age (ESA) 2 million - 150 000 years ago
Middle Stone Age (MSA) 150 000 - 30 000 years ago
Late Stone Age (LSA) 40 000 years ago - 1850 - A.D

A number of Stone Age sites are known in the general geographical area, including Wonderwerk Cave near Kuruman and the Kathu Pan and Kathu Townlands sites (Mitchell 2002:59-70), dating to between the ESA and LSA. A number of single Stone Age tools and larger scatters of stone tools were found during the survey, clear evidence that Stone Age people were active in the area.

3.17.2 Iron Age

The Iron Age is the name given to the period of human history when metal was mainly used to produce artifacts (Coertze & Coertze 1996: 346). In South Africa it can be divided in two separate phases according to Van der Ryst & Meyer (1999: 96-98), namely:

Early Iron Age (EIA) 200 – 1000 A.D.
Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007: xiii) however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

Early Iron Age (EIA) 250 – 900 A.D.
Middle Iron Age (MIA) 900 – 1300 A.D.
Late Iron Age (LIA) 1300 – 1840 A.D.

No Iron Age sites, features or objects were located in the area during the survey. If any did exist they might have been completely destroyed by recent historical mining activities. The closest known Iron Age sites in the wider geographical area include Doornfontein, Blinkklipkop (near Postmasburg) and the well-known Dithakong near Kuruman (Mitchell 2002: 346).

3.17.3 Historical Age

The historical age started with the first recorded oral histories in the area. It includes the moving into the area of people that were able to read and write. This included the expeditions of Anderson (1799), Truter and Somerville (1801), Lichtenstein (1805), Cowan & Donovan (1808), Burchell (1811) and Moffat & Archbell (1829) (Bergh 1999: 12-13 & 117-120).

No recent, historical sites were located in the study area.

Site 1 (S 28.26322 E 23.09560)

This site is a scatter of MSA/LSA stone tools and flakes found near a limestone quarry. The site has a low to medium significance, as the tools are scattered around the area and the area might not be directly impacted on by the mining activities. The documentation (recording and photographs taken) done during the survey is deemed sufficient, although, if opencast operations are to take place here the site and the stone age artifacts need to be collected and mapped in more detail.

Figure 3-25: Site 1: One of the MSA stone tools found here

Site 2 (S 28.25878 E 23.9148)

This is another scatter of MSA/LSA stone tools and flakes found in the area. The site has a low to medium significance, as the tools are scattered around the area and the area might not be directly impacted on by the mining activities. The documentation (recording and photographs taken) done during the survey is deemed sufficient, although, if opencast operations are to take place here the site and the stone age artifacts need to be collected and mapped in more detail.

Figure 3-26: Site 2: MSA/LSA tools and flakes found on the Site 2 scatter

Site 3 (S 28.25840 E 23.08005)

This is a third scatter of MSA/LSA stone tools and flakes found in the area. The site has a low to medium significance, as the tools are scattered around the area and the area might not be directly impacted on by the mining activities. The documentation (recording and photographs taken) done during the survey is deemed sufficient, although, if opencast operations are to take place here the site and the stone age artifacts need to be collected and mapped in more detail.

3.18 Current traffic infrastructure

A copy of the specialist report is attached as Appendix D to this report.

3.18.1 Existing External Road Network

R325 Provincial Road

The R325 is a provincial two-lane paved road linking Postmasburg with the N14 national road towards the north.

The road is shown Fig. 3-27 below:

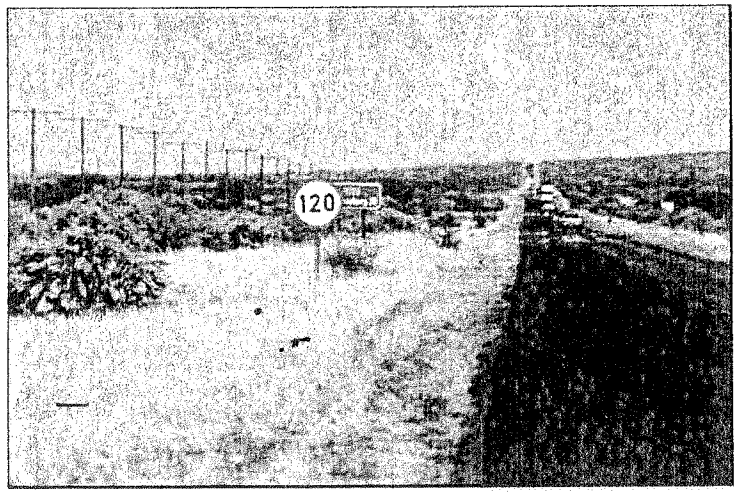


Figure 3-27: *Photo 1: S325 Road*

3.18.2 Existing Land Use

The area under consideration has previously been mined and some of dumps are currently being re-processed. During the prospecting phase bulk sampling also took place which disturbed large areas with no subsequent rehabilitation.

The site is mainly surrounded by mining activities.

3.18.3 Road Planning

There is no road planning in the area that will affect the application.

3.18.4 Access to the Site

As mentioned, this access could possibly have to accommodate approximately 27 heavy vehicle trips per day transporting manganese to Postmasburg. Traffic volumes on the R325 are relatively low with average daily volumes of less than 2000 vehicles, and limited peaking. The mentioned additional trips will be distributed throughout the day and given traffic volumes, levels of service at this access should remain high, even if material is transported via the access.

From a capacity point of view, use of the access by trucks is not a concern.

The access to the western portion, and possibly the access that will also be used for transportation of manganese, is shown in Fig 3-28.

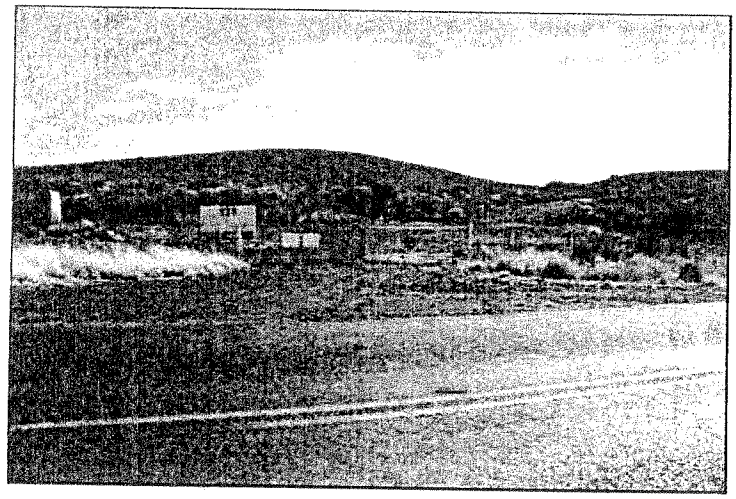


Figure 3-28: *Photo 6: Access to western portion*

3.18.5 Dust Emission

As mentioned, this is not considered in detail as part of this study, but it is important to note that the specific gravel roads tend to be very dusty, which could result in hazardous conditions due to restricted visibility as can be seen in Fig 3-29 below.

Figure 3-29: Dusty road conditions

3.18.6 Roads and Road Pavements

The main question as far as mining on this portion of land is concerned, is whether trucks transporting manganese to Postmasburg from the western portion of the site should use the R325 or whether the gravel road running parallel to the R325 should be reconstructed and used. It was already shown that this road is not required due to capacity considerations and is in fact not recommended from a dust emission point of view.

An aspect to take into consideration is however the condition of the R325 and the possible impact of additional trucks on this road. As mentioned, this study did not deal with road condition in detail, but mainly considered road condition as far as it has an impact on road safety.

The existing R325 is not in a good condition showing cracks and potholes as can be seen in Fig 3-30 below.

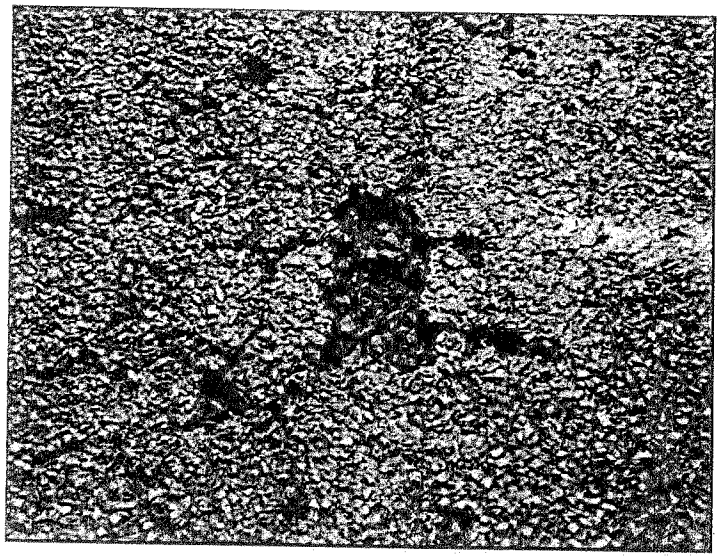


Figure 3-30: Poor road conditions

Of particular concern from a road safety point of view is however the major edge breaking occurring along the length of the road as shown in Fig 3-31.

Figure 3-31: Major edge breaking on road surface

Not only does this create an extremely hazardous edge drop, which could result in overturning of vehicles, but vehicles also tend to shy away from positions with significant edge break as can be seen below. This is obviously hazardous for oncoming traffic. (Fig 3-32)

Figure 3-32: Vehicle shying away from edge break

A further implication of the edge break is that lane widths are decreasing, with the result that heavy vehicles use the whole width of the available lane as shown below, thus reducing the space between the directions of travel. (Fig 3-33)

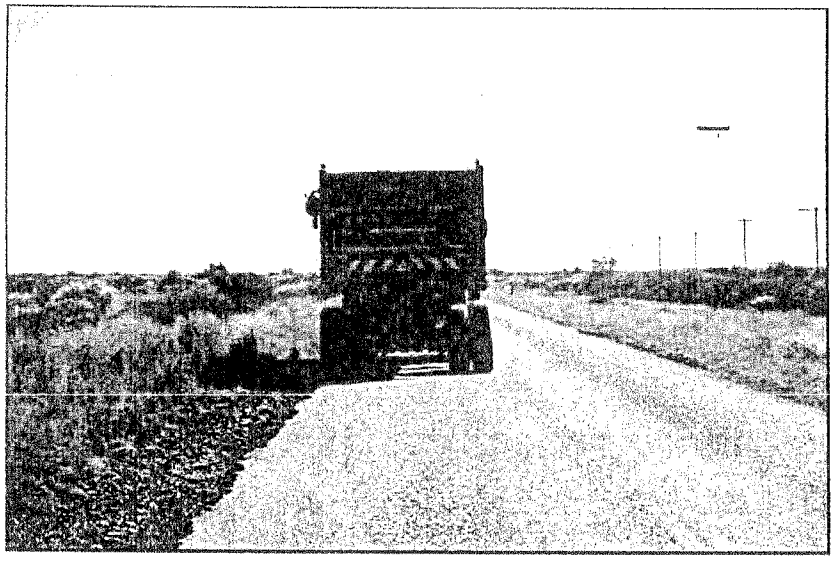


Figure 3-33: Heavy vehicle using the whole width of the available lane

Additional heavy vehicles on the R325 will obviously increase the load on the pavement, especially as damage to roads is mainly caused by heavy vehicles. Based on research undertaken by the CSIR, 60% of road damage is caused by overloaded trucks, with legally-loaded trucks causing about 40% -and light vehicles virtually causing no damage. Although opinions differ, it is generally accepted that an overloaded heavy vehicle causes up to 600 000 times more damage to roads than a light vehicle.

Although the additional trucks transporting manganese will only result in an approximate 2 to 3% increase in vehicles on the road, it must be accepted that the additional trucks will increase damage on the road. The alternative parallel road will remove these trucks from the road.

4. PROJECT ALTERNATIVES

Section 50 (d) of Government Notice R.527 of the MPRDA states that an environmental impact assessment must contain "a comparative assessment of the identified land use and development alternatives and their potential environmental, cultural and social impacts".

Alternatives, in relation to a proposed activity, refer to different means of meeting the general purposes 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.

It is therefore necessary to provide a description of the need and desirability of the proposed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity.

4.1 Proposed mining operation

4.1.1 Design / Layout alternatives

The current layout was chosen by the applicant, because mining will occur in areas that have been previously disturbed by historical mining activities and the old dumps are located in the vicinity. Most existing prospecting infrastructure is also located in this area and will be used or upgraded for the proposed mining purposes. The processing plant will be moved closer to the railway line to reduce the hauling distance of product from the processing plant to the railway line.

If another layout is chosen, it could impact on the little undisturbed areas that are left due to the fact that vegetation and topsoil will have to be removed for construction purposes. By moving the processing plant closer to the railway line it will have the positive effect of a reduced impact of hauling vehicles on the environment, because the hauling vehicles will operate on a smaller area.

4.1.2 Alternative mining method

As a result of the type and location of the mineral resource, no alternative mining method will be considered in the present operation.

4.1.3 'No-go' option

Not proceeding with the project will ensure that the natural remaining flora of the farm will be left in intact, which will have positive consequences for both the animal species frequenting the area and the stability of the ecosystem. The archaeological resources occurring in the area will also be left intact.

The negative side of not proceeding will be that some employees will be left without employment, thereby negatively contributing to the unemployment rates of the Tsantsabane Local Municipality. This could also leave some households without a reliable source of income. Unemployment leads to negative social issues such as crime, alcohol abuse etc.

In turn an opportunity will be lost to make a positive impact on the lives of 30 employees and a positive contribution to the local economy. The biggest opportunity that will be lost is the rehabilitation of the area. The existing dumps will be removed and historical opencast will be backfilled. The area will be landscaped and vegetation reintroduced. All these processes will be introduced into the financial provision of the proposed mining operation.

4.1.4 Land-use alternatives

As was mentioned earlier, the study area has been extensively disturbed by previous mining operations. Prior to the commencement of an activity like livestock farming and/or game farming in the study area, rehabilitation of previously disturbed areas will have to be conducted.

Rehabilitation costs will have to be included into the financial provision of a proposed mining operation. This means that the area will get rehabilitated in the future which will ensure that other activities like livestock and/or game farming would be possible.

4.1.5 Alternative location

No alternative location for the proposed mining operation was considered, as the dumps are only located in the area the applicant applied for.

5. DETAILED PROJECT DESCRIPTION

5.1 Project Infrastructure

5.1.1 Existing Infrastructure

At present the existing surface infrastructure related to the study area can be summarised as follows:

- Old buildings from historical mining activities;
- Old open cast pits from historical mining activities;
- Power lines; and
- Various gravel access roads.

5.1.2 Proposed new infrastructure

This proposed project will consist of the following additional infrastructure:

- A new processing plant;
- Upgrading of historical mining building with toilet facilities;
- Upgrading of historical mining building with food preparation facilities;
- Upgrading of historical mining building with food preparation facilities;
- An 25 000 l diesel storage tank; and
- Upgrading of an old building to a vehicle service area.

5.2 Mine Surface Layout

The preliminary mine surface layout is depicted in Appendix E. The existing surface infrastructures, as well as the proposed infrastructure are indicated on the layout.

5.3 Roads

5.3.1 Access and haul roads

One existing gravel road that turns off from the R325 will be used as the access road and haul road, during prospecting it was upgraded and well maintained. This road located on site is an existing gravel road from historical mining activities.

5.4 Power lines

Currently ESKOM provides the existing farmers and prospecting activities with power via a single 11 kV overhead line. Some of the existing distribution power lines in the study area have to be upgraded to become operational.

5.5 Workshops, Administration buildings and other buildings

One of the existing buildings on site will be upgraded into a vehicle service area. Three old buildings will be upgraded into toilet facilities, administration buildings and an area to prepare food. The toilet facilities will make use of septic tanks and a french drain system.

5.6 Mineral Processing plant

A new processing plant will be built on the disturbed footprint area caused by historical mining and prospecting activities. The new processing plant will comprise of the following:

- Crushing system;
- Conveyer system; and
- Wet screening plant.

5.6.1 Process Description

The selected mining method was designed on the nature of the ore dumps. This involves ore from the different dumps being processed at a central plant and temporarily stored in two product stockpiles. Waste rock will be loaded, hauled and dumped in historical quarries and trenches. The mining sequence was developed so that space will be created for prospective drilling the in-situ resource according to a pre-defined grid. The drilling process forms part of the prospecting activities that have been approved in the prospecting right application and is not included in the actual mining of the ore dumps.

A front-end loader capable of loading 40 ton trucks in three passes will be used, after which the ore will be hauled from the dumps to a crushing and conveyor system. Ore loaded onto trucks will be hauled to a crusher where it will be crushed. The resultant product will be transferred via a conveyor belt to a wet screening plant producing lumpy ore or bigger fraction ore (-63mm to +20mm), containing 35 to 38 percent manganese and a smaller fraction ore (-20mm in size) with a manganese content of 35 to 37 percent manganese.

The following equipment will be used as part of the mining operation:

- Haulers – 5 x CAT 777;
- Loaders – 2 x CAT 992 FEL; and
- Water Trucks – 1 x Bell B40.

Loading and hauling of both waste and ore will be carried out by 15 ton front-end loaders matched with 40 ton rear dump CAT trucks. Working shifts will be arranged so that 750 tons of product, which will constitute 60 percent of material put through the crusher, is produced daily. One CAT D8R Ripper dozer and one CAT 824 Wheel dozer will possibly be acquired in future to exploit an in-situ resource, if it is found to be viable.

5.7 Solid Waste Management Facilities

5.7.1 Solid waste disposal (domestic, Industrial and hazardous)

No solid waste management facilities occur on site. Domestic waste will be stored in containers and will be disposed of at the Postmasburg local municipality waste site.

Industrial and hazardous waste created at the workshops will be stored on site in secure receptacles and will be collected and removed by a licensed contractor and disposed of in a licensed hazardous waste disposal site located off the mine's property.

5.7.2 Sewage

The existing building on site will be fitted with toilets and the raw sewage will be collected in septic tanks and a french drain system will be used. The toilet facilities will be located within the current admin area.

5.8 Diesel Storage

A 25 000 l diesel storage tank will be located on the already impacted footprint area of the plant site. No additional diesel storage is required.

5.9 Mine Waste (Discard and Product stockpiles)

As mentioned before, the ore body will be accumulated into two product stockpiles next to the processing plant. Waste accumulated during processing will be loaded, hauled and dumped in historical quarries and trenches. All residue accumulated during ore processing will have to be stored on a paste disposal site.

5.10 Process Water Supply

Water needed for the processing of the ore will be supplied from existing boreholes on the site. No information has been supplied about the quantities that will be needed.

5.11 Potable Water Supply

Water for potable use will be supplied from existing boreholes located on the site. Approximately 5l per person per day will be utilized, that would amount to 150l per day. It is not foreseen that any additional potable water will be required. The client has indicated that they are in the process of registering for a water use license.

5.12 Project Planning and Associated Activities

5.12.1 Construction Phase

The following activities are proposed:

- Construction of a new process plant;
- Construction of buildings with toilet facilities;
- Construction of buildings with preparation facilities; and
- Upgrading of existing vehicle service area.

During the construction phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Site clearing, which will include the stripping of vegetation, as well as topsoil and subsoil, soil stock piling activities and landscaping activities.
- Establishment of infrastructure which will involve the presence of contractors and staff on site, movement of vehicles on site and waste generation.

5.12.2 Operational Phase

During the operational phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Mining and extraction of resources;
- Processing of resources;
- Transporting of raw material, product and waste;
- Waste rock disposal;
- Domestic and hazardous waste disposal; and
- Administration and other non-mining related activities

5.12.3 Decommissioning and Closure Phase

When the decision is taken to decommission the mine, the following objectives and proposed actions for the decommissioning and closure phase of the mine could be considered depending on the outcomes of the EIA and draft EMP:

- Recovery of all saleable infrastructure;
- Demolition of structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining dumps, piles and slopes are sufficiently shaped to blend in with the surrounding infrastructure;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas;
- Weed management after closure, limited to areas disturbed by mining or included in the mining area.

Monitoring will be undertaken for a specific period after closure or up until such time that all areas create a sustainable cover and ecosystem.

6. PROJECT MOTIVATION

The benefits of the proposed mining operation are detailed below.

6.1.1 Provision of sustainable employment

The proposed mining operation will employ thirty workers from within the borders of the Tsantsabane Local Municipality. It is anticipated that the proposed mining operation will positively impact on the lifestyles of these 30 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.

6.1.2 Provision of a regional socio-economic benefit

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 capitol into the South Africa.

6.1.3 Improved environmental management commitments

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

All mining infrastructure will be dismantled and removed after at the end of life-of-mine. The existing dumps will be removed and historical opencast pits will be backfilled, most 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. All these processes will be introduced into the financial provision of the proposed mining operation. (Refer to Appendix F) for financial provision)

7. PUBLIC CONSULTATION

This section of the report documents the process that was followed with respect to consultation with the interested and affected parties (I&AP's / Stakeholders / Stakeholders) and the Government Authorities.

7.1 Purpose of Public Participation

Public Participation Process (PPP) is a requirement of the EIA and draft EMP process and ensures that all relevant I&APs are consulted and involved. The process ensures that all stakeholders have an opportunity to raise their comments as part of an open and transparent process, which in turn ensures for a complete comprehensive environmental study.

The purpose of PPP and the engagement process is to:

- Introduce the proposed project;
- Explain the processes to be undertaken;
- Determine and record public issues and concerns;
- Provide opportunities for public input and gathering of local knowledge;
- Inform a broad range of stakeholders about the project and the environmental process to be followed;
- Establish lines of communication between stakeholders and the project team;
- Identify all the significant issues in the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent environmental impacts, associated with the project.

Once the concerns of I&APs have been established, the EIA and draft EMP study aims to address these concerns.

A list of I&APs can be found in **Appendix G**

7.2 Authorities

The following Authorities have been identified and invited to become involved in the process to date:

National Government authorities:

- Department of Minerals and Energy (DME); and
- The Department of Public Works

District Municipalities:

- Siyanda Districts Municipality.

Local Municipalities:

- Tsantsabane Local Municipality.

Other Authorities:

- Eskom; and
- Transnet Ltd.

7.3 Interested and Affected parties (Stakeholders)

7.3.1 Identification of I&APs

The existing comprehensive list of I&AP's / Stakeholders, has been updated by GCS through a process of networking, press advertisements and notices.

The I&APs database can be found in Appendix G

7.3.2 Informing stakeholders

7.3.2.1 Site notices

Site notices were placed at the entrances of the study area by the applicant.

7.3.2.2 Media advertisement

Media advertisements were placed in the DFA (regional newspaper) and the Volksblad on 26 February 2009. This advert contained the information required in terms of Government Notice R385 of the National Environmental Management Act (no. 207 of 1998). Appendix H contains the notification advertisement that was placed in the newspapers

7.3.2.3 Telephonic Consultation

Most land owners were contacted telephonically with the purpose of informing these parties about the proposed mining activities of the applicant, explaining the application process and enquiring about any potential objections or concerns regarding the proposed project.

7.3.2.4 Background Information Documents

GCS made a Background Information Document (BID) (Refer to Appendix I) available to all I&AP's / stakeholders via e-mail, fax and/or post. The BID included details of the proposed project as well as the Scoping and EIA / EMP purpose, requirements and process. It also included relevant contact details and a comment / registration sheet. I&AP's were invited to register and send responses by letter, fax, telephone or e-mail to GCS. Appendix J contains proof of registration of letters to potential interested and/or affected parties.

7.3.2.5 Issues and Responses Document

Ongoing communication (i.e. telephonic, meetings, emails, fax etc.) has been undertaken to ensure an open and transparent channel of communication. All stakeholders and I&APs were given the opportunity to raise their concerns with regards to the proposed project. All comments and/or concerns received have been noted and will be incorporated within the detailed investigations as part of the EIA and draft EMP phase. The channel of communication is ongoing and members of the public will have the opportunity to voice their comments and concerns throughout the environmental process. Please refer to Table 7-1 for the issues trail.

Table 7-1: Issues Trail and Responses

Issue Raised	Raised by whom	Response
No objection will be raised provided that Eskom's right and services are acknowledged and respected at all times, and the requirements as laid down by the Occupational Health and Safety Act No. 85/93, are complied with. (Refer to Appendix K)	ESKOM	Eskom's right and services will be acknowledged and respected at all times
No objections raised provided the applicant conform to the issues raised in a letter that was received. (Refer to Appendix K)	Transnet	All issues raised are noted.

8. OBJECTIVES

There is existing infrastructure in the project area with a well-established network of roads and electrical power lines. Existing servitudes will be used as far as possible.

All of the objectives outlined in this section are based on the central tenet of Best Practical Environmental Option. All planning and implementation will take place in such a manner that environmental risks are minimized, mitigated and where possible removed all together.

The following activities will be addressed in the impact assessment phase:

Construction Phase:

- Removal of vegetation;
- Stripping of soil; and
- Establishment of infrastructure.

Operational Phase:

- Operation of loading and hauling vehicles on site;
- Operation of processing plant;
- Handling of plant residue and dirty water;
- Use of access and haul roads by hauling vehicles;
- Disposal of waste rock;
- Disposal of general and domestic waste; and
- Storage, handling and disposal of hydrocarbons.

Decommissioning and closure phase the following activities are envisaged:

- Recovery of all saleable infrastructure;
- Demolition and removal of all buildings and structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining piles and slopes are sufficiently shaped to blend in with the surrounding environment;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;

- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas; and
- Weed management after closure, limited to areas disturbed by mining or included as infrastructure related to the mine.

8.1 Proposed activities and mining objectives

8.1.1 Construction phase

8.1.1.1 Removal of vegetation and stripping of topsoil

The environmental objectives associated with the removal of vegetation and stripping of topsoil associated with this project are:

- To ensure that only vegetation and topsoil be removed if deemed necessary;
- To take care that no new land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;
- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To ensure an effective surface run-off control system is in order;
- To prevent, contain and clean up any spillages during the construction activities;
- To reduce the noise associated with the removal activities as far as possible, especially around the conveyor system; and
- To reduce the dust dispersion as a result of the removal of earth material as far as possible.

8.1.1.2 Establishment of infrastructure

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

- Optimal utilisation and maintenance of existing infrastructure as planned for the overall project in a well-planned manner where possible;
- Ongoing maintenance of infrastructure in a well-planned manner;
- To take care that no new land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;

- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To ensure an effective surface run-off control system is in order from the commissioning of the construction activities to deal with the separation of clean and dirty water;
- To prevent, contain and clean up any spillages during the construction and operational activities;
- To reduce the noise associated with the construction and operational activities as far as possible, especially around the conveyor system;
- To reduce the dust dispersion as a result of the removal of earth material as far as possible;
- To manage the influx of people seeking work and the potential for informal establishment and associated petty crimes; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

8.1.2 Operational Phase

8.1.2.1 Domestic and Hazardous Waste Generation

The environmental objectives associated with the generation of waste are:

- To enforce policies in terms of the removal of domestic and hazardous waste;
- To ensure an effective surface run-off control system is in order to deal with the separation of clean and dirty water;
- The proper handling of sanitation (sewage);and
- To prevent, contain and clean up any spillages during the life of mine.

8.1.2.2 Waste rock disposal operations

The environmental objectives associated with waste rock disposal are to:

- To take care that no new land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;
- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To implement measures as part of the management programme to reduce any potential impact on rare or endangered species;

- To ensure an effective surface run-off control system is in order to deal with the separation of clean and dirty water;
- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To reduce the noise associated with the removal activities as far as possible;
- To reduce the dust dispersion as a result of the disposal of material as far as possible; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

8.1.2.3 Product stockpile operations

The environmental objectives associated with the stockpiling product and waste are:

- To take care that no new land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;
- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To implement measures as part of the management programme to reduce any potential impact on rare or endangered species;
- To ensure an effective surface run-off control system is in order to deal with the separation of clean and dirty water;
- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To prevent, contain and clean up any spillages in the environment;
- To reduce the noise associated with removal activities as far as possible;
- To reduce the dust dispersion as a result of the disposal of material as far as possible; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

8.1.2.4 Administrative buildings and associated operations

The environmental objectives in terms of the operation within administrative buildings are:

- Optimal utilisation and maintenance of administrative buildings in a well-planned manner;
- Ensure that the land surface, habitats, vegetation and animals are not destroyed, disturbed and/or alienated unnecessarily;

- To contain and prevent any pollution from these areas with structures and facilities;
- Sanitation (sewage management and treatment); and
- Ensure that an effective surface run-off control system is in place in order to deal with the separation of clean and dirty water.

8.1.2.5 Plant residue and dirty water operations

The environmental objectives associated with plant residue and dirty water operations are to:

- Optimal utilisation and maintenance of infrastructure as planned for the overall project in a well-planned manner where possible;
- Ongoing maintenance of infrastructure in a well-planned manner;
- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To ensure an effective surface run-off control system is in order to deal with the separation of clean and dirty water;
- To prevent any cumulative impact (i.e. erosion and siltation of watercourses) associated with the removal of vegetation and topsoil;
- To prevent, contain and clean up any spillages in the environment; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

8.1.2.6 Mining and processing operations of Iron ore and Manganese ore

The environmental objectives associated with the mining of Iron ore and Manganese ore are:

- To optimally utilise the mineral reserves within a well planned mining strategy;
- To take care that no new land surface, vegetation and habitats outside of the planned mining area are destroyed, disturbed and/or alienated;
- To ensure that the original topography is disturbed as little as possible;
- To ensure an effective surface run-off control system is in order;
- To reduce the noise associated with the operational activities as far as possible;
- To reduce the dust dispersion as a result of the removal of Iron ore and manganese ore reserves as far as possible;
- To have an open channel of communication with the surrounding land owners to ensure that all the needs of parties are adhered to as far as practically possible;

- To ensure that the area is safe and will not present a hazard to animal and/or human life; and
- The sustainable and responsible utilization (re-use) of all water resources and the prevention of pollution thereof.
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

8.2 Decommissioning phase

The environmental objectives associated with the decommissioning phase:

- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical;
- To ensure that the area gets rehabilitated to pre-mining conditions (as far as is reasonably possible); and
- To re-establish natural vegetation and control alien vegetation.

9. ASSESSMENT OF IMPACTS

Potential impacts and issues have been determined throughout the environmental process. The scoping phase served to identify the possible impacts as per desktop studies and issues that were identified, or raised by I&APs. Once the baseline conditions were determined and the possible impacts were identified, detailed specialists studies were conducted. The specialist studies were aimed at identifying the impacts associated with the project, but also to determine the probability of such impacts occurring, the extent and duration of such impacts and the intensity in terms of the biophysical and socio-economic environment. Once this was identified the significance of the various impacts was determined and appropriate management measures were identified. The significance of the impacts was then reassessed with the assumption of the management measures implemented effectively.

The following section provides a summary of the rating methodology utilised. Thereafter, the detailed discussion of the impacts is presented in a tabular format.

9.1 Environmental Impact Significance Rating Methodology

To ensure uniformity, the assessment of potential impacts will be addressed in a standard manner so that a wide range of impacts are comparable. For this reason a clearly defined rating scale will be provided to the specialist to assess the impacts associated with their investigation. Each impact identified will be assessed in terms of probability (likelihood of occurring), extent (spatial scale), intensity (severity) and duration (temporal scale). To enable a scientific approach to the determination of the impact significance (importance), a numerical value will be linked to each rating scale. The sum of the numerical values will define the significance. The following criteria will be applied to the impact assessment for the DCM West Expansion Project EIA/EMP.

Table 9-1: Probability

Category	Rating	
Definite	4	The impact will definitely occur.
Probable	3	The impact is highly likely to occur.
Possible	2	The impact has some possiblility, but low likelihood of occurring.
Improbable	1	The impact is not likely to occur except in extreme and/or rare conditions.

Table 9-2: Extent

Category	Rating	Description
Site	1	Immediate project site
Local	2	Up to 5 km from the project site
Regional	3	20 km radius from the project site
Provincial	4	Provincial
National	5	South African
International	6	Neighbouring countries/overseas

Table 9-3:: Duration

Category	Rating	Description
Very short-term	1	Less than 24 hours
Short-term	2	Less than 1 year
Medium-term	3	1 to 5 years
Long-term	4	5 to 15 years
Very long-term	5	Greater than 15 years
Permanent	6	Permanent

Table 9-4: Intensity

Category	Rating	Description
Very low	0	Where the impact affects the environment in such a way that natural, cultural and social functions are not affected
Low	2	Where the impact affects the environment in such a way that natural, cultural and social functions are only marginally affected
Medium	4	Where the affected environment is altered but natural, cultural and social function and processes continue albeit in a modified way
High	6	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily cease
Very high	8	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease

The significance is calculated by means of the following equation:

Probability + Extent + Duration + Intensity

Table 9-5: Significance Rating

Score	Significance Rating
3-6	Low
7-10	Low to Moderate
11-15	Moderate
16-19	Moderate to High
20-24	High

9.2 Construction Phase

At present most of the infrastructure of the proposed mining operation is already existing from historical mining and prospecting activities. The only activities that will have to take place are the construction and upgrading of certain infrastructure.

The following activities are proposed:

- A new processing plant;
- Upgrading of historical mining building with toilet facilities;
- Upgrading of historical mining building with food preparation facilities;
- Upgrading of historical mining building with food preparation facilities;
- A 25 000 l diesel storage tank; and
- Upgrading of an old building to a vehicle service area.

During the construction phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Site clearing, which will include the stripping of vegetation, as well as topsoil and subsoil, soil stock piling activities and landscaping activities.
- Establishment of infrastructure which will involve the presence of contractors and staff on site, movement of vehicles on site and waste generation.

It should be noted that there is no surface water present on the proposed mining area, only non-perennial rivers are present. Therefore, the occurrence of impacts associated with surface water is very low. However these impacts will be discussed due to the fact there may have an effect on surface water outside the application area.

9.2.1 Preparation of footprint areas

In all undisturbed areas before any construction activities are undertaken, the vegetation will be removed, and the topsoil will be stripped and stockpiled. Most infrastructure will be located on historically disturbed areas with little or no existing topsoil and vegetation.

Table 9-6: Impacts as a result of the preparation of the footprint areas

Aspect	Direct Impact	Indirect and Cumulative Impacts
Removal of Vegetation	Vegetation destruction Visual impact Loss of faunal habitat	Topographical alterations due to increased surface water runoff Loss of soil resources due to erosion Dust dispersion Habitat destruction Alien invader flora establishment
Stripping of topsoil	Loss of soil resource and associated erosion Visual impact Noise generation Fugitive dust generation	Loss of land capability Loss of seedbed Alien vegetation establishment

Table 9-7: Environmental impact significance rating and management measures associated with the removal of vegetation

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No impacts envisaged						
Topography	The removal of vegetation will allow for increased surface water runoff, which may in turn lead to topographical alterations.	3	1	2	2	8 Low to Moderate	All areas of construction must be clearly demarcated No construction of project related activities may be undertaken outside of the demarcated areas. The removal of vegetation will be phased in order to ensure minimal soil exposure at any time. Erosion control measures will be incorporated into all design drawings and will be implemented during the construction phase.
	With management measures	2	1	2	0	5 Low	
Soils and Land Capability	The removal of vegetation will expose soils, allowing for increased soil erosion due to increased water runoff.	3	1	2	6	12 Moderate	The re-establishment of natural vegetation will be encouraged. Should re-establishment of vegetation not take place, re seeding options will be investigated. Where disturbed areas cannot be re-vegetated during the life of operations, appropriate measures will be taken to control wind erosion. Re-vegetate areas if exposed for longer than 18 months.
	With management measures	2	1	2	0	5 Low	
Flora	Part of the activities undertaken in the	2	1	4	4	11 Moderate	Vegetation clearing will be done in phases - only the areas

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	construction phase will involve the removal of the vegetation cover from the areas to be used for the new structure which will lead to loss of biodiversity, which may include protected species.						requiring clearance at a specific point in time for construction activities to take place.
							Natural vegetation self-succession will be encouraged. In areas disturbed the main Grass species will be reintroduced after fertilization has been added.
							Construction activities should be limited to the designated areas.
							Should protected and/or red data species be present on site these should be relocated in consultation with the relevant authorities.
							Weed eradication and control will be actively managed during the construction, operational and decommissioning phases of the mine.
	With management measures	2	1	2	2	7 Low to Moderate	
	Dust deposition on plants may occur during the construction activity. This may reduce the potential of growth in flora and impact on the habitat of the fauna in the area.	3	1	2	4	10 Low to Moderate	Effective dust management practices should be employed.
							Wet suppression will take place as and when required.
							Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.
	With management measures	3	1	2	2	8 Low to Moderate	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	The removal of vegetation will provide opportunity for the spread of weeds and alien invasive vegetation.	3	1	2	4	10 Low to Moderate	The proposed mine will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new.
	With management measures	2	1	2	2	7 Low to Moderate	
Fauna	The loss of habitat will have an effect on the fauna in the area. Most, if not all animal species will leave the area of disturbance and find alternate habitat in the vicinity. This will however have a minor impact owning to the fact that extensive mining and prospecting activities have been taking place in the area and as a result, the species diversity is low.	2	1	4	2	9 Low to Moderate	Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.
							Should protected and/or red data species be present on site these should be relocated in consultation with the relevant authorities.
	With management measures	1	1	3	2	7 Low to Moderate	
Groundwater	No further impacts envisaged						
Surface Water	The removal of vegetation during construction will have an impact in terms of soils being washed away into non-perennial watercourses.	4	2	2	6	14 Moderate (-)	Storm water controls will be established prior to the commencement of construction activities.
							Erosion control measures will be implemented.
							Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							Construction activities should be undertaken in winter months where practically possible. In winter months there is very little precipitation.
	With management measures	3	1	2	2	8 Low to Moderate	
Heritage	No further impacts envisaged						
Air Quality	Fugitive dust emissions as a result of the vegetation clearing and associated bare areas may have a negative impact in terms of air quality and visual characteristics.	3	1	4	4	12 Moderate	Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.
							Natural vegetation self-succession will be encouraged. In areas disturbed the main Grass species will be reintroduced after fertilization has been added.
							Construction activities should be limited to the designated areas.
							Speed limits will be implemented for all vehicles on site
							Dust suppression techniques will be investigated and implemented.
	With management measures	2	1	4	2	9 Low to Moderate	
Visual	Fugitive dust emissions as a result of the soil stockpiling process will have a negative impact in terms of visual characteristics.	3	1	4	4	12 Moderate (-)	The minimum amount of existing vegetation and topsoil will be removed from the designated construction areas.
							Natural vegetation re-establishment will be encouraged.
							Speed limits will be implemented for all vehicles on site
							Dust suppression techniques will be investigated and

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							implemented.
	With management measures	2	1	4	2	9 Low to Moderate	
Noise	No significant impact						
Socio-economical	No significant impact						

Table 9-8: Environmental impact significance rating and management measures associated with soil stripping and stockpiling activities

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	The stripping of soil will allow for increased surface water runoff, which may in turn lead to topographical alterations.	3	1	5	4	13 Moderate	Topsoil will be stockpiled on designated areas where it will not be contaminated.
							The height of the soil stockpiles will range between 1.5 and 3m.
							Erosion control measures will be implemented where stockpiles exceed a height of 1.5m, however re-establishment of vegetation will be encouraged. Should re-establishment of vegetation not take place, re seeding options will be investigated.
	With management measures	2	1	2	2	7 Low to Moderate	
Soils and Land	Soil stripping, will expose soils,	4	1	3	2	10 Low to Moderate	The re-establishment of natural vegetation will be

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Capability	allowing for increased soil erosion due to increased surface water runoff.						encouraged. Should re-establishment of vegetation not take place, re seeding options will be investigated.
							Where disturbed areas cannot be re-vegetated during the life of operations, appropriate measures will be taken to control wind erosion.
							Effective dust management measures will be employed by the mine.
							Re-vegetate areas if exposed for longer than 18 months and are not going to be used in future.
							Erosion control and storm water run-off control measures will be implemented
	With management measures	2	1	2	2	7 Low to Moderate	
	Soil physical and chemical degradation may occur as a result of the soil stripping and stockpiling, which in turn would lead to the loss of the soil resource and will impact the soil physical characteristics.	4	1	2	4	11 Moderate	Topsoil and subsoil will be stripped to at least 250mm or until hard rock is reached.
							Stockpile soils separately from rocks and or spoil material.
							Erosion control measures will be implemented where stockpiles exceed a height of 1.5m, however all topsoil and subsoil stockpiles will be vegetated.
							The topsoil and overburden that is collected will be stockpiled in such a way that dust and water erosion is limited.
							Stockpiles will be constructed in such a way to ensure

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							stability and thereby preventing the possibility of wash down.
							Soils which are stripped could be used in the construction of berms or other storm water management measures.
							If soils are not used in the construction of berms, they should be stored as close as possible to the area where they will be utilised for rehabilitation as separate managed stockpiles so that they can be easily accessed and used for rehabilitation at closure.
							The mine will ensure that equipment movement over the stockpiles is limited to reduce soil compaction, soil structure or the associated seed bank.
							The re-establishment of natural vegetation on the stockpiles will be encouraged. Should re-establishment not take place, re-seeding and fertilisation options will be investigated and implemented.
							The disturbed areas around the support structures should be managed carefully in order to avoid erosion especially where shallow soils will be encountered
	With management measures	2	1	2	0	5 Low	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	After the soil has been removed from the areas designated for the new structures, the bare areas will be susceptible to both wind and water erosion.	4	1	3	2	11 Low to Moderate	Storm water controls will be established prior to the commencement of construction activities.
	With management measures	2	1	2	2	7 Low to Moderate	
Flora	Alien invasive vegetation establishment is possible on the topsoil stockpiles. This would also impact the integrity of the seed bed as it would contain alien plant seed.	3	1	5	4	13 Moderate	The mine will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions during ongoing mining operation and decommissioning. Monitoring of weeds will be undertaken on a six monthly schedule and this may be extended monthly in the summer seasons if required.
	With management measures	1	1	2	2	6 Low	
	Dust deposition on plants may occur during the construction activity. This will reduce the potential of growth in flora and impact on the habitat of the fauna in the area.	3	2	3	4	12 Moderate	Effective dust management practices should be employed
	With management measures	2	1	2	2	7 Low to moderate	
Fauna	No further impacts are envisaged						
Groundwater	No further impacts are envisaged						
Surface water	The stripping of soils and the	4	2	4	4	14 Moderate	Storm water controls will be established prior to the

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	associated bare surfaces will have an impact in terms of soils washing away especially during intensive rainstorms, which could have an effect on surface water.						commencement of construction activities. Erosion control measures will be implemented. The topsoil and overburden that is collected will be stockpiled in such a way that dust and water erosion is limited. Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down. A berm, should it be necessary will be constructed down gradient of the mining infrastructure to prevent wash down soil.
	With management measures	1	1	2	0	4 Low	
Air Quality	Fugitive dust emissions as a result of the soil stockpiling process will have a negative impact in terms of air quality and visual characteristics.	3	1	3	4	11 Moderate	Stockpiles will only be placed on their designated areas within the mine boundary. The heights of all stockpiles will be restricted. Erosion control measures will be implemented where stockpiles exceed a height of 1.5m, however all topsoil and subsoil stockpiles will be vegetated or alternatively natural vegetation will be allowed to develop. Speed limits will be implemented for all vehicles on site Dust suppression techniques will be investigated and implemented.
	With management measures	2	1	1	0	4 Low	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Visual	Fugitive dust emissions as a result of the soil stockpiling process will have a negative impact in terms of visual characteristics.	3	1	4	4	12 Moderate	Stockpiles will only be placed on their designated areas within the mine boundary.
							The heights of all stockpiles will be restricted.
							Erosion control measures will be implemented where stockpiles exceed a height of 1.5m, however all topsoil and subsoil stockpiles will be vegetated or alternatively natural vegetation will be allowed to develop.
							Speed limits will be implemented for all vehicles on site
							Dust suppression techniques will be investigated and implemented.
	With management measures	2	1	1	0	4 Low	
Noise	Noise will be generated as a result from the removal, transport and stockpiling of topsoil.	4	1	2	2	9 Low to Moderate	All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order.
	With management measures	3	1	2	0	6 Low	
Socio-economic	No further impacts envisaged						

9.2.2 Landscaping activities

After the footprint areas have been prepared, landscaping activities will be undertaken. The landscaping activities are mostly associated with the levelling of the ground level and the presence of vehicles on site.

Table 9-9: Cumulative impacts as a result of the preparation of the landscaping activities

Aspect	Direct Impact	Indirect and Cumulative Impacts
Levelling of ground level	Change in topography	Increase in erosion due to a change in the topography Noise impacts due to earth moving activities associated with landscaping activities. Visual impact associated with a change in the topography
Movement of vehicles on site	Soil compaction Soils pollution due to hydrocarbon spills Noise generation Fugitive dust generation	

Table 9-10: Environmental impact significance rating and management measures associated with the levelling of ground level

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No significant impact						
Topography	Landscaping activities will result in topographical alterations	2	1	2	2	7 low to Moderate	Landscaping will be limited to those areas requiring alteration. Where possible, topographical alteration will be designed to take the natural topography of the area into account.
	With management measures	1	1	2	0	4 Low	
Soils and Land Capability	No further impacts are envisaged as soil management would have been successfully undertaken						

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	during the stripping of topsoil.						
Flora	No further impacts envisaged						
Fauna	No further impacts envisaged						
Groundwater	No further impacts envisaged						
Surface Water	Landscaping will alter the natural drainage patterns of the area.	3	1	3	4	11 Moderate	Erosion control measures will be implemented during the construction activities especially during vegetation and soil stripping.
	With management measures	2	1	2	2	7 Low to Moderate	
Heritage	No further impacts envisaged						
Air Quality	No further impacts envisaged						
Visual	Fugitive dust emissions as a result of the landscaping process will have a negative impact in terms of visual characteristics.	2	1	3	4	10 Low to Moderate	The minimum amount of existing vegetation and topsoil will be removed from the designated construction areas. Natural vegetation re-establishment will be encouraged.
	With management measures	1	1	2	2	6 Low	
Noise	Earth moving activities during the landscaping phase will cause a noise disturbance.	4	1	2	4	12 Moderate	All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order.
	With management measures	3	1	1	2	7 Low to Moderate	
Socio-economic	No further impact envisaged						

Table 9-11: Environmental impact significance rating and management measures associated with the movement of vehicles on site

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and Land Capability	The use of heavy machinery during the construction process will result in the compaction of soil, resulting in decreased infiltration of rain water and increased surface run-off volumes and velocities leading to a greater erosion risk.	4	3	3	2	12 Low to Moderate	All areas not directly within the footprint of the proposed infrastructure where the soil has been compacted will need to be ripped to break up the compacted soil surface. This will aid infiltration and decrease run-off.
							All ripped areas the re-establishment of natural vegetation will be encouraged. Should re-establishment of vegetation not take place, re-seeding options will be investigated.
							All re-vegetated areas should be monitored to ensure successful re-establishment of natural vegetation and to prevent invasion by alien species.
	With management measures	2	1	2	2	7 Low to Moderate	
	Soil pollution due to the spillages of hydrocarbons along the access, construction and haul routes.	3	2	1	2	8 Low to Moderate	Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.
							The management of hydrocarbon spills should form part of the emergency preparedness and response programme.
							No activities associated with hydrocarbons and or chemicals

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							(i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.
	With management measures	2	2	1	2	7 Low to Moderate	
Flora	No further impacts envisaged						
Fauna	The loss of fauna due to road kills with roads utilised in the area.	4	1	3	4	12 Moderate	Speed restrictions will be implemented to manage road usage.
							Clear signs will be erected in areas where animal crossings may be prone.
	With management measures	2	1	2	2	7 Low to moderate	
Groundwater	No further impacts envisaged						
Surface water	No further impacts envisaged						
Heritage	No further impacts envisaged						
Air Quality	Fugitive dust emissions from the exposed surface area, and vehicle movement will negatively affect the air quality.	3	1	4	4	12 Moderate	A dust management programme will be investigated and implemented.
							Dust suppression techniques will be investigated and implemented.
							Roads will be treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.
							Speed restrictions will be implemented to manage road usage.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	With management measures	2	1	1	2	6 Low	
Visual	Increase in dust could lead to a negative visual impact.	3	2	2	2	9 Low to Moderate	Roads will be treated or surfaced in order to reduce fugitive dust emissions on the aesthetics of the surrounding area.
	With management measures	2	1	1	0	4 Low	
Noise	An increase in ambient noise levels will be experienced by the movement of vehicles on the access and haul roads.	4	2	1	2	9 Low to Moderate	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.
							Vehicles will be equipped with mufflers where practical to reduce the emission of noise.
	With management measures	3	1	1	0	5 Low	
Socio-economic	No further impacts envisaged						

9.2.3 Establishment of Infrastructure

Once the area has been prepared the establishment of infrastructure will commence. The generation of waste (construction waste and general waste), and staff on site is also associated with the establishment of infrastructure.

Table 9-12: Cumulative impacts as a result of the establishment of infrastructure

Aspect	Direct Impact	Indirect and Cumulative Impacts
Construction of infrastructure	Soil compaction Loss of soil resource and associated erosion Vegetation destruction Loss of faunal habitat Visual impact Noise generation Fugitive dust generation	Loss of land capability Alien vegetation establishment
Waste generation (construction waste and general waste)	Soil pollution Visual impact Loss of faunal habitat	None
Staff on site (this section is discussed in Table 9-15 as a general aspect throughout the construction activities)	Influx of job seekers Harvesting of plants Poaching of animals Pollution due to incorrect disposal of domestic waste	Demographic and cultural problems

Table 9-13: Environmental impact significance rating and management measures associated with the construction of infrastructure

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Topography	No further impacts envisaged as the landscaping activities would have made provision for the topographic requirements.						
Soils and Land Capability	The construction of infrastructure will alter the land capability of the area.	4	1	5	4	14 Moderate	Construction activities should be limited to the designated areas. No related activities may be undertaken outside of the designated areas. The boundaries will be fenced off to prevent unnecessary impacts on surrounding land capabilities. All fences will be routinely inspected and maintained. The surrounding land (not used for mining or operational purposes) will be kept in the state it was prior to the mining related construction activities.
	With management measures	4	1	5	2	12 Moderate	
Flora	No further impacts envisaged						
Fauna	No further impacts envisaged						
Groundwater	No further impacts envisaged						
Surface Water	No further impacts envisaged						
Heritage	No further impacts envisaged						
Air Quality	Fugitive dust emissions from the exposed surface area, and vehicle	3	1	4	4	12 Moderate	A dust management programme will be investigated and implemented.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	movement will negatively affect the air quality.						Dust suppression techniques will be investigated and implemented.
							Roads will be maintained, treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.
	With management measures	2	1	1	2	6 Low	
Visual	Increase in dust could lead to a negative visual impact.	3	2	2	2	9 Low to Moderate	Roads will be treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.
	With management measures	2	1	1	0	4 Low	
Noise	Construction activities will increase the ambient noise levels in the area. The increase in noise is however temporary.	4	2	1	2	9 Low to Moderate	All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order.
							Where noise becomes a nuisance, management measures will be investigated and implemented to address these.
	With management measures	3	1	1	0	5 Low	
Socio-economic	No further impacts envisaged						

Table 9-14: Environmental impact significance rating and management measures associated with construction waste generation

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and Land Capability	The generation of waste may lead to soil contamination.	4	2	2	2	10 Low to Moderate	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.
							Waste management will form a detailed component as part of the induction process provided by the mine.
							The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner.
	With management measures	2	1	1	0	4 Low	
Flora	The generation and improper disposal of waste could impact local ecosystem function.	4	2	2	2	10 Low to Moderate	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.
							Waste management will form a detailed component as part of the induction process provided by the mine.
							The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,
	With management measures	2	1	1	0	4 Low	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Fauna	The generation and improper disposal of waste could impact local ecosystem function.	4	2	2	2	10 Low to Moderate	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.
							Waste management will form a detailed component as part of the induction process provided by the mine.
							The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner.
	With management measures	2	1	1	0	4 Low	
Groundwater	The leachate from waste storage sites may cause groundwater contamination.	2	2	2	2	8 Low to Moderate	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.
							Waste management will form a detailed component as part of the induction process provided by the mine.
							The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,
							A groundwater monitoring programme will be developed and implemented.
							Boreholes will be monitored for groundwater level and quality on a quarterly basis.
	With management measures	1	1	1	0	3 Low	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Surface Water	No further impacts envisaged, the site does not have any perennial surface water.						
Heritage	No further impacts envisaged						
Air Quality	No further impacts envisaged						
Visual	Waste accumulation may have a negative visual impact	4	2	2	2	10 Low to Moderate	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.
							Waste management will form a detailed component as part of the induction process provided by the mine.
							The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner.
	With management measures	2	1	1	0	4 Low	
Noise	No further impacts envisaged						
Socio-economic	No further impacts envisaged						

9.3 Operational Phase

The operational phase will comprise of the following activities that could lead to potential impacts. Please refer to Section 5 for a detailed activity description.

During the operational phase of this project, the proposed mine will consist of the following:

- Processing plant;
- Discard dump;
- Product stockpile area;
- Slimes dam;
- Administration, workshops, buildings with toilets facilities and food preparation facilities, and all associated structures.
- Power lines; and
- Access roads.

The main activities that will be undertaken during the operational phase will be the following:

- Mining and extraction of resources;
- Processing of resources;
- Transporting of raw material, product and waste;
- Waste rock disposal;
- Domestic and hazardous waste disposal; and
- Administration and other non-mining related activities.

Most mining activities will occur in areas disturbed by previous mining and prospecting activities. These areas have already been stripped of vegetation and topsoil. If any topsoil and vegetation occur in proposed mining areas the same management measures will be implemented as described in the construction phase under the removal of vegetation, and soil stripping and stockpiling activities.

It should be noted that there is no surface water present on the proposed mining area, only non-perennial rivers are present. Therefore, the occurrence of impacts associated with surface water is very low. However these impacts will be discussed due to the fact there may have an effect on surface water outside the application area.

The handling of plant waste water and dirty water refers to all water and residue collected after it was used in processing.

9.3.1 Mining and extraction of resources

Table 9-15: Impacts as a result of mining and extraction of resources

Aspect	Direct Impact	Indirect and Cumulative Impacts
Operation of loading and hauling vehicles on site	Dust generation Soils pollution due to hydrocarbon spills	Noise generation Visual impact

Table 9-16: Environmental impact significance rating and management measures associated with loading and hauling vehicles

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and land capability	Soil pollution due to the spillage of hydrocarbons on the mining site.	3	1	1	4	9 Low to Moderate	Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices. The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme. No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.
	With management areas	3	1	1	2	7 Moderate	
Flora	Windblown dust from the mining site could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant vigour.	4	2	5	4	15 Moderate	A dust monitoring programme will be investigated and implemented. Dust must be suppressed by using a dust suppression method.
	With management areas	4	1	3	4	12 Moderate	
	The presence of disturbed land caused by loading and hauling vehicles, could allow the establishment of alien invasive vegetation.	3	1	5	4	13 Moderate (-)	The mine will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions.
	With management areas	1	1	2	2	6 Low (-)	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Fauna	Noise could have an impact on animals in the area (Refer to noise management measures in table).						
Groundwater	No further impacts envisaged						
Surface water	No further impacts envisaged						
Heritage	No further impacts envisaged						
Air Quality	Dust emissions from vehicle movement and operation will negatively affect the air quality.	3	2	5	4	15 Moderate	A dust management programme will be investigated and implemented. Dust suppression techniques will be investigated and implemented. Speed restrictions will be implemented to manage fugitive dust emissions from road usage.
	With management areas	2	1	5	2	10 Low to Moderate	
Visual	No further impacts envisaged						
Noise	Loading vehicle operations will increase the ambient noise levels in the area.	4	1	1	2	8 Low to Moderate	All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order. Where noise becomes a nuisance, management measures will be investigated and implemented to address these. Vehicles will be equipped with mufflers where practical to reduce the emission of noise.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	With management measures	3	1	1	0	5 Low	
Socio-economic	Noise could disturb neighbouring farmers (Refer to noise management measures above)						

9.3.2 Processing of resources

Table 9-17: Impacts as a result of the processing of resources

Aspect	Direct Impact	Indirect and Cumulative Impacts
Operation of the processing plant	Dust generation Soil pollution due to hydrocarbon spills	Noise generation Visual Impact
Handling of plant residue and dirty water	Possible groundwater and surface water pollution Possible soil contamination	Possible deterioration of water quality outside mining area Loss of ecological function in surface water bodies outside of the mining area.
Product stockpiles	Stockpiles will alter the topography of the site Runoff from stockpiles may remove material and flow into existing surface water resulting in the	Possible deterioration of water quality outside mining area Fugitive dust emissions may create a visual impact

Aspect	Direct Impact	Indirect and Cumulative Impacts
	siltation thereof Deterioration of surface water due to diffuse pollution The stockpiles will have a visual impact Noise will be produced during the stockpiling process The stockpiling process will create fugitive dust emissions	

Table 9-18: Environmental impact significance rating and management measures associated with the operation of the plant

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and land capability	Soil pollution due to possible spillages of hydrocarbons during processing.	3	1	1	4	9 Low to Moderate	Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices. The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme. No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							effectively designed contained area.
	With management areas	2	1	1	4	8 Low to Moderate	
Flora	Windblown dust from the processing could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant vigour.	3	1	5	4	13 Moderate	A dust monitoring programme will be investigated and implemented. Dust must be suppressed by using a dust suppression method.
	With management areas	2	1	3	2	8 Low to Moderate	
Fauna	No further impacts envisaged						
Groundwater	No further impacts envisaged						
Surface water	No further impacts envisaged						
Heritage	No further impacts envisaged						
Air Quality	Dust emissions from processing will negatively affect the air quality.	3	1	5	4	13 Moderate	A dust management programme will be investigated and implemented. Dust suppression techniques will be investigated and implemented.
	With management areas	2	1	5	2	10 Low to Moderate	
Visual	Dust emissions from processing plant will have visual impacts (visual intrusion, visibility and visual exposure).	4	1	1	2	8 Low to Moderate	A dust management programme will be investigated and implemented. Dust suppression techniques will be investigated and implemented.
	With management measures	3	1	1	0	5 Low	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Noise	An increase in ambient noise levels will be experienced by the movement of vehicles on the access and haul roads.	4	1	1	2	8 Low to Moderate	Processing equipment will be serviced regularly and be kept in good working order. Where noise becomes a nuisance, management measures will be investigated and implemented to address these.
	With management measures	3	1	1	0	5 Low	
Socio-economic	No further impacts envisaged						

Table 9-19: Environmental impact significance rating and management measures associated with the handling of plant residue and dirty water

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and land capability	Leachage from the waste and dirty control dams could adversely affect the soil quality	4	2	4	4	14 Moderate	The water storage facilities will be regularly monitored for leaks and siltation and will be adequately maintained. Dirty water dams will be lined by a suitable liner to limit the potential for leakage.
		2	1	2	2	7 Low to Moderate	
Flora	No further impacts envisaged						
Fauna	Animals drinking the dirty water in the containment dams may impact on their	3	1	4	2	11 Moderate	Access to open water must be limited as far as practically possible

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	health.						
	With management measures	2	1	2	2	7 Low to Moderate	
Groundwater	Seepage from the waste and dirty control dams could adversely affect the groundwater quality.	4	2	4	4	14 Moderate	The water storage facilities will be regularly monitored for leaks and siltation and will be adequately maintained. Dirty water dams will be lined by a suitable liner to limit the potential for leakage. A detailed groundwater monitoring programme will be investigated and implemented. Liner systems will be regularly inspected and repaired/replaced as required ensuring continued functionality.
		2	1	2	2	7 Low to Moderate	
Surface water	Leakage from the waste and dirty control dams could adversely affect the surface water quality.	3	1	4	2	11 Moderate	The water storage facilities will be regularly monitored for leaks and siltation and will be adequately maintained. A detailed surface water monitoring programme will be implemented. Dirty water dams will be lined by a suitable liner to limit the potential for leakage.
		2	1	3	2	7 Low to Moderate	
Heritage	No further impacts envisaged						
Air Quality	No further impacts envisaged						
Visual	No further impacts envisaged						

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Noise	No further impacts envisaged						
Socio-economic	No further impacts envisaged						

Table 9-20: Environmental impact significance rating and management measures associated with product and waste rock stockpiles

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	Stockpiles will alter the topography of the area.	4	2	4	4	14 Moderate	Product and waste rock stockpile size will be kept to minimum and will be removed on a continuous basis.
							Stockpiles will be kept in demarcated areas.
		3	1	3	2	9 Low to Moderate	
Soils and Land Capability	No further impacts envisaged						
Flora	No further impacts envisaged						
Fauna	No further impacts envisaged						
Groundwater	The stockpiling of material may lead to a decrease in groundwater quality through the infiltration of contaminated water.	2	1	4	2	9 Low to Moderate (-)	A groundwater monitoring procedure will be investigated and implemented.
							Should the groundwater monitoring reveal that the quality of groundwater available to surrounding users is affected due to mining activities; an alternative water resource will be provided to replace the loss.
							Uncontrolled stockpiling of product will be avoided and

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							cleaned up immediately when detected.
							The product and waste rock stockpiles should be kept as small as possible. This will reduce the volume of potentially poor quality leachate infiltrating the aquifers. The base of the product and waste rock stockpile should be compacted to reduce the permeability and therefore the infiltration.
	With management measures	2	1	3	2	7 Low to Moderate (-)	
Surface Water	Runoff from stockpiles will flow into non-perennial rivers especially during intensive rainstorms.	2	1	4	2	9 Low to Moderate (-)	Berms, should they be necessary, will be constructed upstream and downstream of the dumps and stockpiles to ensure that clean water is kept separate from dirty water. Water contained in the berms downstream will evaporate.
							All berms will be sized so as to prevent spilling for up to a 1:50 year storm event.
							The dumps will be constructed in such a way that dust and water erosion is limited.
							Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down
	With management measures	2	1	3	2	7 Low to Moderate (-)	
Heritage	No significant impact						
Air Quality	Fugitive dust emissions from the stockpiles will have a negative visual impact.	3	1	4	4	12 Moderate (-)	A dust monitoring and management programme will be investigated and implemented.
							Dust suppression techniques will be investigated and implemented.
							Should it be found that the stockpiles create excessive dust,

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							measures must be implemented to reduce this impact.
	With management measures	2	1	3	2	8 Low to Moderate (-)	
Visual	The removal, transportation and stockpiling of material will have a visual impact.	3	1	4	4	12 Moderate (-)	Refer to management measures in waste rock disposal facility table
	With management measures	2	1	3	2	8 Low to Moderate (-)	
Noise	No further impacts envisaged						
Socio-economic	No further impacts envisaged						

9.3.3 Transporting of raw material, product and waste

Table 9-21: Impacts as a result of transporting of raw material, product and waste

Aspect	Direct Impact	Indirect and Cumulative Impacts
Movement of vehicles on gravel access and haul roads	Visual impact Deterioration of gravel roads Soils pollution due to hydrocarbon spills Noise generation Dust generation	Dust impacting flora Disturbance of local people (if applicable)

Table 9-22: Environmental impact significance rating and management measures associated with transporting of raw material, product and waste

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and land capability	Soil pollution due to the spillages of hydrocarbons along the access and haul routes.	3	1	1	4	9 Low to Moderate	Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices. The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme. No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.
	With management areas	2	1	1	2	6 Low	
Flora	Windblown dust from the roads could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant vigour.	3	2	5	2	12 Moderate	A dust monitoring programme will be investigated and implemented. Dust must be suppressed by using a dust suppression method.
	With management areas	2	1	3	0	6 Low	
Fauna	No further impacts envisaged						
Groundwater	No further impacts envisaged						

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Surface water	The presence of linear infrastructure could lead to an increase in volume and speed of surface water run-off which will increase the erosive capacity of the water. This is due to channelling of water along the road surface.	4	1	4	4	13 Moderate	Roads will be maintained throughout the life of mine on a continuous basis. Roads will be maintained, treated or surfaced with gravel in order to reduce the impact of water run-off Berms, should they be necessary will be constructed next to the road to reduce surface water runoff.
	With management areas	1	1	2	2	6 Low	
Heritage	No further impacts envisaged						
Air Quality	Dust emissions from vehicle movement and operation will negatively affect the air quality.	3	2	5	2	12 Moderate	A dust management programme will be investigated and implemented. Dust suppression techniques will be investigated and implemented. Roads will be maintained, treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area. Speed restrictions will be implemented to manage road usage.
	With management areas	2	1	5	0	8 Low to Moderate	
Visual	The access and haul roads will have visual impacts (visual intrusion, visibility and visual exposure).	4	1	1	2	8 Low to Moderate	Roads will be maintained, treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	With management areas	3	1	1	0	5 Low	
Noise	An increase in ambient noise levels will be caused by the movement of vehicles on the access and haul roads.	4	1	1	2	8 Low to Moderate	All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order. Where noise becomes a nuisance, management measures will be investigated and implemented to address these. Vehicles will be equipped with mufflers where practical to reduce the emission of noise.
	With management areas	3	1	1	0	5 Low	
Socio-economic	No further impacts envisaged						

9.3.4 Waste rock dump disposal

Table 9-23: Impacts as a result of the waste rock disposal facility

Aspect	Direct Impact	Indirect and Cumulative Impacts
Development of waste rock disposal facility	Runoff from waste rock dumps may remove material and flow into existing non-perennial surface water resulting in the siltation thereof The waste rock dumps will have a visual impact Noise will be produced during the waste rock	Topographical alterations Deterioration of water quality Fugitive dust emissions may create a visual impact

Aspect	Direct Impact	Indirect and Cumulative Impacts
	dumping process The waste rock dumping process will create fugitive dust emissions	

Table 9-24: Environmental impact significance rating and management measures associated with the development of a waste rock disposal facility

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and Land Capability	No further impacts envisaged						
Flora	Windblown dust from the roads could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant vigour.	4	2	5	4	15 Moderate	A dust monitoring programme will be investigated and implemented. Dust suppressed must be implemented.
	With management areas	4	1	3	4	11 Moderate	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Fauna	No further impacts envisaged						
Groundwater	No further impact envisaged						
Surface Water	Runoff from stockpiles may flow into non-perennial watercourses (especially during intensive rainstorms). This results in siltation, which adversely affects the water quality in summer months.	2	1	4	2	9 Low to Moderate (-)	Berms, should they be required, will be constructed upstream and downstream of the dumps and stockpiles to ensure that clean water is kept separate from dirty water. Water contained in the berms downstream will evaporate. All berms will be sized so as to prevent spilling for up to a 1:50 year storm event. Dumps will be removed on a continuous basis and dumped into the historical open cast pits. This will keep the dumps to a minimal size. The dumps will be constructed in such a way that dust and water erosion is limited. Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down.
	With management measures	2	1	3	2	7 Low to Moderate (-)	
Heritage	No significant impact						
Air Quality	Fugitive dust emissions from the stockpiles and the transport of discard material will have a negative air quality	3	1	4	4	12 Moderate (-)	A dust monitoring and management programme will be investigated and implemented. Dust suppression techniques will be investigated and

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	impact.						implemented.
							Should it be found that the stockpiles create excessive dust; measures must be implemented to reduce this impact.
	With management measures	2	1	3	2	8 Low to Moderate (-)	
Visual	The removal, transport and storage of discard material will have a visual impact (visual intrusion, visibility and visual exposure of discard dumps).	3	1	4	4	12 Moderate (-)	Discard dump heights will be restricted
							Discard dumps will only be placed within the mine area boundaries.
							The visual management measures as incorporated during the construction phase will be maintained during the operational phase.
							Dumps will be removed on a continuous basis and dumped into the historical open cast pits. This will keep the dumps to a minimal size and amount
	With management measures	2	1	3	2	8 Low to Moderate (-)	
Noise	Noise will be generated during the removal, transport and dumping of materials.	4	2	2	2	10 Low to Moderate (-)	All workers will have access to and wear noise reduction personal protection equipment (PPE) appropriate to their working conditions.
							Noise monitoring will be undertaken throughout the life of the mining activities to ensure that noise levels comply with Safety and Health Standards.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							The noise management measures as incorporated during the construction phase will be maintained during the operational phase.
	With management measures	3	1	1	0	4 Low (-)	
Socio-economic	No further impacts envisaged						

9.3.5 Domestic waste and hazardous waste disposal

Table 9-25: Impacts as a result of domestic waste and hazardous waste disposal

Aspect	Direct Impact	Indirect and Cumulative Impacts
Generation and disposal of domestic and general waste	Surface water and soil contamination Waste accumulation may have a negative visual impact The generation and improper disposal of waste may impact upon ecosystem function Domestic waste accumulation may attract pest faunal species	Contaminated soils and surface water may have ecological implications Contamination of water may present a health risks to local people and fauna

Aspect	Direct Impact	Indirect and Cumulative Impacts
Storage, handling and disposal of hydrocarbons (Refer to	Contamination of soils, surface water and groundwater due to spills or improper disposal Potential fires fuelled by combustible hydrocarbons may create risks for people, fauna and flora	Contaminated soils and water may impact on local ecology

Table 9-26: Environmental impact significance rating and management measures associated with waste generation

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and Land Capability	The generation and inappropriate disposal of waste may lead to soil contamination.	4	1	2	2	9 Low to Moderate (-)	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded. Waste management will form a detailed component as part of the induction process provided by the mine. The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner.
	With management measures	2	1	1	0	4 Low (-)	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Flora	The generation and improper disposal of waste could impact local ecosystem function.	4	1	2	2	9 Low to Moderate (-)	Please refer to the management measures above.
	With management measures	2	1	1	0	4 Low (-)	
Fauna	The generation and improper disposal of waste could impact on fauna as it could impact on the habitats, but the waste can also be consumed which could lead to diseases.	4	1	2	2	9 Low to Moderate (-)	Please refer to the management measures above.
	With management measures	2	1	1	0	4 Low (-)	
Groundwater	The leachate from waste storage sites may cause groundwater contamination.	4	1	2	2	9 Low to Moderate (-)	Please refer to the management measures above. A groundwater monitoring programme will be developed and implemented. Boreholes will be monitored for groundwater level and quality
	With management measures	2	1	1	0	4 Low (-)	
Surface Water	The generation of waste may lead to surface water contamination	4	1	2	2	9 Low to Moderate (-)	Please refer to the management measures above. A surface water monitoring programme will be developed and implemented
	With management measures	2	1	1	0	4 Low (-)	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Heritage	No further impacts envisaged						
Air Quality	No further impacts envisaged						
Visual	Waste accumulation may have a negative visual impact	4	2	2	2	10 Low to Moderate (-)	Please refer to the management measures above.
	With management measures	2	1	1	0	4 Low (-)	
Noise	No further impacts envisaged						
Socio-economic	No further impacts envisaged						

Table 9-27: Environmental impact significance rating and management measures associated with the storage, handling and disposal of hydrocarbons (HCS)

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						
Topography	No further impacts envisaged						
Soils and Land Capability	The use of diesel, oil and other hazardous chemical substances may lead to the contamination of soils.	3	1	4	4	12 Low to moderate	All hydrocarbons should be stored in designated, bunded areas with a capacity of at least 110% of the volume stored.
							Spill kits should be readily available and all employees must be trained in the utilisation thereof.
							Should a spill take place the area should be cleaned

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							immediately and the contaminated area will be rehabilitated as appropriate.
							Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.
							The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.
							In the event of a major spill that could result in major soil and water contamination the DWAF should be informed immediately and a remediation strategy should be enforced.
							The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.
							No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.
	With management measures	2	1	3	2	8 Low to Moderate	
Flora	The improper storage procedures of diesel, oil and other hazardous chemical substances may lead to	2	1	3	4	13 Moderate (-)	Refer management measures above.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	the contamination of destruction of flora.						
	With management measures	1	1	1	0	3 Low (-)	
Fauna	The handling and storage of fuel creates a fire risk. This could negatively impact the local fauna.	3	2	5	8	18 Moderate to High (-)	There shall be an emergency preparedness plan is in place in order to fight accidental fires should they occur. The adjacent land owners/users/managers should also be informed and/or involved.
							The induction and awareness programmes will address fire-related issues.
							There must be sufficient fire-fighting equipment. This equipment must fulfil the South African Occupation Health and Safety requirements.
							All vegetation adjacent to the fuel storage tanks will be continually removed.
							All provisions relating to fire safety will be related during the induction and awareness training programme
	With management measures	2	1	3	2	8 Low to Moderate (-)	
Groundwater	Hazardous chemical spills may reach groundwater, thereby	3	1	5	4	13 Moderate (-)	Please refer to the management measures above.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	impacting its quality.						A detailed groundwater monitoring programme will be implemented.
	With management measures	2	1	3	2	8 Low to Moderate (-)	
Surface Water	The use of diesel, oil and other hazardous chemical substances may lead to the contamination of surface water	4	2	5	4	15 Moderate (-)	Please refer to the management measures above.
							A detailed surface water monitoring programme will be implemented.
	With management measures	2	1	3	2	8 Low to Moderate (-)	
Heritage	No further impacts envisaged						
Air Quality	No further impacts envisaged						
Visual	No further impacts envisaged						
Noise	No further impacts envisaged						
Socio-economic	Injury to employees due to fire hazard	3	2	6	4	15 Moderate	Refer to management measures above
	With management measures	2	1	6	2	11 Moderate	

9.4 Decommissioning Phase

The decommissioning phase will commence once the mining operations has reached the end of life, and will involved:

- Demolishment of all infrastructure (plants, ancillary, etc.); and
- Removal of linear infrastructure (conveyors, railway, roads and pipelines).

Following cessation from mining activities and processing, it is planned that all infrastructure will be decommissioned and removed from site in a systematic and regulated matter.

Table 9-28: Cumulative impacts as a result of the decommissioning activities

Aspect	Direct Impact	Indirect and Cumulative Impacts
Dismantling and removal of infrastructure	The natural topography will be restored through the removal of the infrastructure Generation of construction waste may affects soils and land capability, surface water and the local ecology The removal of infrastructure will leave a temporary bare "scar" on the landscape, creating a visual impact The removal process will increase the ambient noise levels in the area Fugitive dust will be created by wind erosion from exposed surfaces	Restoration of natural topography Soil and surface water contamination will have ecological implications The presence of disturbed land may allow the establishment of alien invasive vegetation The presence of exposed soils may lead to an increase in volume and speed of surface water run-off, increasing the erosive capacity (increased erosion)
Active rehabilitation	The ripping and landscaping will restore the area to that of a more natural, gentle topography The rehabilitation will remove the visual incongruity	The ripping of soils will result in greater groundwater recharge due to the softening of surfaces

9.4.1 Dismantling and removal of infrastructure

Following cessation of mining and processing, it is planned that all infrastructures will be decommissioned and removed from site in a systematic and regulated manner. The proposed project can only proceed, depending on the findings of the Environmental Impact Assessment (EIA) and the decision of the relevant environmental authorities. Such an outcome could then result in the actual decommissioning of the mine as the production would come to an end over time.

Buildings

- All infrastructures will be removed and rehabilitated, should no alternative use be found for the structures.
- Foundations will be removed to a depth of 1m below surface.
- An alternative use for the brick structures will first be sought i.e. they can either be sold/donated to the post-mining landowner on sale of the land. If an alternative use cannot be found, the buildings will be demolished.
- All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, sold as scrap or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).

Linear infrastructure

Linear infrastructure constructed by the mine (i.e. roads and power lines) will be removed if it proves to inhibit land use at decommissioning. Where possible infrastructure will remain for social investment opportunities, this will be decided in conjunction with Integrated Development Plan (IDP) of the area and the local authorities (i.e. municipality). The soils and land capability will be rehabilitated to near pre-mining conditions.

- All haul roads will be rehabilitated by ripping these structures to a depth of 500mm.

- All fences erected around the mine will be dismantled and either disposed of at a permitted disposal site or sold as scrap (provided these structures will no longer be required by the post-mining land owner). Fences erected to cordon-off dangerous excavations will remain in place and will be maintained as and when required.

Dams

- All containment dams will be maintained to ensure that no leakages occur.
- Overflow pipes will be kept clean.
- Sumps will be kept clean and all pumps will be maintained.
- The containment dams will only be demolished should the area proof to be free draining with no pollution potential after rehabilitation.

Table 9-29: Impacts associated with the dismantling and removal of infrastructure

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No significant impact						
Topography	No significant impact						
Soils and Land Capability	The removal of the plant will produce waste, which may lead to soil contamination.	4	1	2	2	9 Low to Moderate (-)	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste streams. These containments will be colour coded.
							Waste management will form a detailed component as part of the induction process provided by the mine.
							The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	With management measures	3	1	2	0	6 Low (-)	
	The utilisation of hydrocarbons and other chemicals during the removal of the plant may lead to the contamination of soils.	3	1	2	2	8 Low to Moderate (-)	All hydrocarbons should be stored in designated, bunded areas with a capacity of at least 110% of the volume stored.
							Spill kits should be readily available and employees must be trained in the utilisation thereof.
							Should a spill take place the area should be cleaned immediately and the contaminated area will be rehabilitated as appropriate.
							Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.
							In the event of a major spill that could result in major soil and water contamination the DWAF should be informed immediately and a remediation strategy should be enforced.
							The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.
							No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.
	With management measures	3	1	1	0	5 Low (-)	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Flora	The removal of the plant and rehabilitation of the site will expose the soils on site and allow the re-establishment of natural vegetation.	3	2	6	2	13 Moderate (+)	The mine will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions during ongoing mining operation and decommissioning.
	With management measures	3	2	6	4	15 Moderate (+)	
Fauna	The re-establishment of vegetation on site will provide a habitat for fauna (Refer to Flora management measures)	3	1	6	2	12 Moderate (+)	
Groundwater	The utilisation of hydrocarbons and other chemicals during the removal of the plant may lead to the contamination of groundwater through filtration.	3	1	2	2	8 Low to Moderate (-)	Refer to table in construction phase - storage, handling and disposal of hydrocarbons (HCS)
	With management measures	3	1	1	0	5 Low (-)	
Surface Water	The removal of the plant will produce waste, which may lead to surface water contamination.	4	2	3	2	11 Moderate	Refer to waste generation table
	With management measures	4	1	3	2	10 Low to moderate	
	The utilisation of hydrocarbons and other chemicals during the removal of the plant leads to the	1	1	2	2	8 Low to moderate	Please refer to the Groundwater section above for the correct handling and management procedures for hydrocarbons.

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	contamination of surface water.						
	With management measures	1	1	1	0	3 Low	
Heritage	No further impacts envisaged						
Air Quality	No further impacts envisaged						
Visual	The removal of the plant will improve the visual quality of the site by removing the visual incongruity.	4	1	6	4	15 Moderate to High	Natural vegetation establishment (self-succession) will be encouraged. The mine will investigate an appropriate seed mix for the rehabilitation purposes should self-succession not establish on rehabilitated sites. An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping, will be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. Attempts will be made to restore the natural character of the landscape.
	With management measures	4	1	6	4	16 Moderate to High	
Noise	The removal of the plant will increase the ambient noise levels in the area. This is however only temporary.	4	1	2	2	9 Low to Moderate (-)	Vehicles will be equipped with mufflers where practical to reduce the emission of noise. Where noise becomes a nuisance management measures will be investigated and implemented to address these. Induction and awareness training will address the need to

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
							keep noise to a minimum.
	With management measures	3	1	1	0	5 Low to Moderate	
Socio-economic	No further impacts envisaged						

9.4.2 *Active rehabilitation*

- Active rehabilitation of the area will involve the following:
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining piles and slopes are sufficiently shaped to blend in with the surrounding environment;
- Amelioration and vegetation of all disturbed areas should this be required;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas; and
- Weed management after closure, limited to areas disturbed by mining or included as infrastructure related to the mine.

Table 9-30: Impacts associated with active rehabilitation

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Geology	No further impacts envisaged						

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Topography	Landscaping of the area will have a positive impact on the overall topography of the area.	4	1	6	6	17 Moderate to High	
	With management measures	4	1	6	6	17 Moderate to High	
Soils and Land Capability	Ripping and topsoil replacement will restore the soil physical characteristics prior to re-vegetation. This is a positive impact to the environment.	4	2	6	4	16 Moderate to High (+)	Compacted soils will be ripped and topsoil will be replaced. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be allowed to re-vegetate the area.
	With management measures	4	2	6	6	18 Moderate to High (+)	
Flora	Self-succession will be encouraged, should this fail re-vegetation will be undertaken on the decommissioned and rehabilitated areas before mine closure. This will be a positive impact to the flora and fauna of the area.	4	2	6	4	16 Moderate to High (+)	Compacted soils will be ripped and topsoil will be replaced. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Remove alien vegetation post decommissioning, with long term follow-up afterwards
	With management measures	4	2	6	4	16 Moderate to High (+)	
Fauna	The re-establishment of vegetation	4	1	6	4	15 Moderate	Refer to Flora management measures

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
	on site will provide a habitat for fauna						
	With management measures	4	2	6	6	18 Moderate to High	
Groundwater	No further impacts envisaged						
Surface Water	No further impacts envisaged						
Heritage	No further impacts envisaged						
Air Quality	Fugitive dust will be created by wind erosion from exposed surfaces due to infrastructure removal.	3	1	4	4	12 Moderate (-)	Wet suppression techniques will be implemented to limit dust dispersion where and when necessary.
	With management measures	2	1	3	2	8 Low to Moderate (-)	
	Vehicle-entrained fugitive dust emissions.	3	1	4	4	12 Moderate (-)	Wet suppression techniques will be implemented to limit dust dispersion where and when necessary. Speed limits will be implemented for all vehicles on site to reduce dust emissions
	With management measures	2	1	3	2	8 Low to Moderate (-)	
	Tailpipe emissions from vehicles.	3	1	4	4	12 Moderate (-)	A vehicle maintenance schedule will be developed and implemented.
	With management measures	2	1	3	2	8 Low to Moderate (-)	

Environmental Parameter	Impact Description	Probability	Extent	Duration	Intensity	Significance	Management Measures
Visual	The rehabilitation (ripping, topsoil replacement and landscaping) will remove the visual incongruity. An overall visual improvement will be noticed once all mining related infrastructure has been demolished and the area has been landscaped and re-vegetated. In general the removal of infrastructure is seen as a positive impact to the environment.	4	2	6	4	16 Moderate to High (+)	Final shaping will be implemented, such that, the final profile of the rehabilitated mining areas are formed to emulate natural contours of the area.
	With management measures	4	2	6	6	18 Moderate to High (+)	
Noise	Improperly maintained vehicles / machinery may produce excessive noise.	4	2	2	2	10 Low to Moderate (-)	Vehicles will be equipped with mufflers where practical to reduce the emission of noise. Where noise becomes a nuisance, management measures will be investigated and implemented to address these.
	With management measures	3	1	1	0	5 Low (-)	
Socio-economic	Prior to the closure of the mine, retrenchments will be made.	4	4	6	6	20 High (-)	Continue with the skills development programme to empower the workforce to undertake other activities.
	With management measures	3	3	3	4	13 Moderate (-)	

10. ENVIRONMENTAL MANAGEMENT PROGRAMME

10.1 Management measures

Potential impacts and issues have been determined throughout the environmental process. The scoping phase served to identify the possible impacts as per desktop studies and issues that were identified, or raised by I&APs. Once the baseline conditions were determined and the possible impacts were identified, detailed specialists studies were conducted. The specialist studies were aimed at identifying the impacts associated with the project, but also to determine the probability of such impacts occurring, the extent and duration of such impacts and the intensity in terms of the biophysical and socio-economic environment. Once this was identified the significance of the various impacts was determined and appropriate management measures were identified. The significance of the impacts was then reassessed with the assumption of the management measures implemented effectively.

10.1.1 Construction Phase

During the construction phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Site clearing, which will include the stripping of vegetation, as well as topsoil and subsoil, soil stock piling activities and landscaping activities.
- Establishment of infrastructure which will involve the presence of contractors and staff on site, movement of vehicles on site and waste generation.

Table 10-1: Impacts as a result of the preparation of the footprint areas

Aspect	Direct Impact	Indirect and Cumulative Impacts
Removal of Vegetation	Vegetation destruction Visual impact Loss of faunal habitat	Topographical alterations due to increased surface water runoff Loss of soil resources due to erosion Dust dispersion Habitat destruction Alien invader flora establishment
Stripping of topsoil	Loss of soil resource and associated erosion	Loss of land capability

Aspect	Direct Impact	Indirect and Cumulative Impacts
	Visual impact Noise generation Fugitive dust generation	Loss of seedbed Alien vegetation establishment

Table 10-2: Environmental impact significance rating and management measures associated with the removal of vegetation

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					
Topography	The removal of vegetation will allow for increased surface water runoff, which may in turn lead to topographical alterations.	8 Low to Moderate	All areas of construction must be clearly demarcated	Draw up a plan clearly defining the construction area.	Prior to construction	Project Manager
			No construction of project related activities may be undertaken outside of the demarcated areas.	Workers should complete induction prior to construction activities being undertaken.	Prior to construction	Project Manager
			The removal of vegetation will be phased in order to ensure minimal soil exposure at any time.	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation.	Prior to construction	Project Manager
			Erosion control measures will be incorporated into all design drawings and will be implemented during the construction phase.	Draws up a topsoil stockpile procedure, indicating the depth of topsoil to be removed, the location of the stockpile areas as well as reflecting the method of stripping, stockpiling and stockpile management. Brief contractors on the topsoil stockpile procedure and enforce implementation thereof.	Prior to construction	Project Manager
	With management measures	5 Low (-)				

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Soils and Land Capability	The removal of vegetation will expose soils, allowing for increased soil erosion due to increased water runoff.	12 Moderate (-)	The re-establishment of natural vegetation will be encouraged. Should re-establishment of vegetation not take place, re seeding options will be investigated.	Draw up the plan implement the plan and monitor the area.	Prior to construction	Project Manager
			Where disturbed areas cannot be re-vegetated during the life of operations, appropriate measures will be taken to control wind erosion	Construct the required erosion protection measures.	During construction	Project Manager
				Ensure the required erosion protection measures are maintained, monitored and corrected where necessary.	During construction	Project Manager
			Re-vegetate areas if exposed for longer than 18 months.	Draw up the plan implement the plan and monitor the area.	During construction	Project Manager
	With management measures	5 Low (-)				
Flora	Part of the activities undertaken in the construction phase will involve the removal of the vegetation cover from the areas to be used for the new structures which will lead to loss of biodiversity, which may include protected species	11 Moderate	Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation.	Prior to construction	Project Manager
			Natural vegetation self-succession will be encouraged. In areas disturbed the main Grass species will be reintroduced after fertilization has been added.	Draw up the plan implement the plan and monitor the area.	During construction	Project Manager
			Construction activities should be limited to the designated areas.	Draw up a plan clearly defining the construction area.	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
				Workers should complete induction prior to construction activities being undertaken.	Prior to construction	Project Manager
			Should protected and/or red data species be present on site these should be relocated in consultation with the relevant authorities, such as the MTPA and MDALA.	Brief workers on the Environmental Awareness Plan and report findings were relevant	During Construction	Environmental Coordinator
			Weed eradication and control will be actively managed during the construction, operational and decommissioning phases of the mine.	Identify any current invader species in the area by means of a survey	Prior to construction	Project Manager
				Draw up an eradication, spread prevention as well as monitoring plan for invader species.	Prior to construction	Project Manager
				Implement the plan and monitor the area	During construction	Project Manager
	With management measures	7 Low to Moderate (-)				
	Dust deposition on plants may occur during the construction activity. This may reduce the potential of growth in flora and impact on the habitat of the fauna in the area.	10 Low to Moderate (-)	Effective dust management practices should be employed.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractors responsibility.	Prior to construction	Project Manager
			Wet suppression will take place as and when required.	Include the dust suppression techniques as part of the dust	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
				management plan within the construction activities		
			Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation.	Prior to construction	Project Manager
	With management measures	8 Low to Moderate (-)				
Fauna	The loss of habitat will have an effect on the fauna in the area. Most, if not all animal species will leave the area of disturbance and find alternate habitat in the vicinity. This will however have a minor impact owning to the fact that extensive mining and prospecting activities have been taking place in the area and as a result, the species diversity is low.	9 Low to Moderate	It is likely that the animals will move to the surrounding areas when the construction activities start. The animals will move back once mining activities have ceased and rehabilitation has taken place.	None		
			Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation.	Prior to construction	Project Manager
				Workers should complete induction prior to construction activities being undertaken.	Prior to construction	Project Manager
				Draw up a plan clearly defining the construction area.	Prior to construction	Project Manager
	With management measures	7 Low to Moderate (-)				

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Groundwater	No further impacts envisaged					
Surface Water	The removal of vegetation during construction will have an impact in terms of soils being washed away into non-perennial watercourses.	14 Moderate (-)	Storm water controls will be established prior to the commencement of construction activities.	Design all structures to ensure clean and dirt water separation as stipulated in Regulation 704 of the National Water Act.	Prior to construction	Project Manager
				Maintain and monitor the implementation of dirty water separation.	During construction	Project Manager
			Erosion control measures will be implemented.	Construct the required erosion protection measures.	During construction	Project Manager
				Ensure the required erosion protection measures are maintained, monitored and corrected where necessary.	During construction	Project Manager
			Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation.	Prior to construction	Project Manager
			Construction activities should be undertaken in winter months where practically possible. In winter months there is very little precipitation.	Plan construction activities to start outside the rainy season where practically possible	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	With management measures	8 Low to Moderate (-)				
Heritage	No further impact envisaged					
Air Quality	Fugitive dust emissions as a result of the vegetation clearing and associated bare areas may have a negative impact in terms of air quality and visual characteristics.	12 Moderate (-)	Vegetation clearing will be done in phases - only the areas requiring clearance at a specific point in time for construction activities to take place.	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation.	Prior to construction	Project Manager
			Natural vegetation self-succession will be encouraged. In areas disturbed the main Grass species will be reintroduced after fertilization has been added.	Draw up the plan implement the plan and monitor the area.	Prior to construction	Project Manager
			Construction activities should be limited to the designated areas.	Draw up a plan clearly defining the construction area.	Prior to construction	Project Manager
			Speed limits will be implemented for all vehicles on site	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	During construction	Project Manager
			Dust suppression techniques will be investigated and implemented.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractors responsibility.	Prior to construction	Project Manager
				Include the dust suppression techniques as part of the dust management plan within the construction activities	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	With management measures	9 Low to Moderate (-)				
Visual	Fugitive dust emissions as a result of the soil stockpiling process will have a negative impact in terms of visual characteristics.	12 Moderate (-)	The minimum amount of existing vegetation and topsoil will be removed from the designated construction areas.	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation.	Prior to construction	Project Manager
			Natural vegetation re-establishment will be encouraged.	Draw up the plan implement the plan and monitor the area.	Prior to construction	Project Manager
			Speed limits will be implemented for all vehicles on site	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	During construction	Project Manager
			Dust suppression techniques will be investigated and implemented.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractors responsibility.	Prior to construction	Project Manager
				Include the dust suppression techniques as part of the dust management plan within the construction activities	Prior to construction	Project Manager
	With management measures	9 Low to Moderate				
Noise	No significant impact					
Social	No significant impact					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	Soil physical and chemical degradation may occur as a result of the soil stripping and stockpiling, which in turn would lead to the loss of the soil resource and will impact the soil physical characteristics.	11Moderate (-)	Topsoil and subsoil will be stripped to at least 250mm or until hard rock is reached.	Draw up a topsoil stockpile procedure, indicating the depth of topsoil to be removed, the location of the stockpile areas as well as reflecting the method of stripping, stockpiling and stockpile management.	Prior to construction	Project Manager
			Stockpile soils separately from rocks and or spoil material	Brief contractors on the topsoil stockpile procedure and areas and enforce the implementation thereof.	Prior to construction	Project Manager
			Erosion control measures will be implemented where stockpiles exceed a height of 1.5m, however all topsoil and subsoil stockpiles will be vegetated.	Construct the required erosion protection methods.	During construction	Project Manager
			The topsoil and overburden that is collected will be stockpiled in such a way that dust and water erosion is limited.	Ensure the required erosion protection measures are maintained, monitored and corrected where necessary.	During construction	Project Manager
			Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down.	Draw up a surface water monitoring programme to prevent, manage and monitor potential erosion.	Prior to construction	Project Manager
			Soils which are stripped could be used in the	Ensure the required erosion	During	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
		moderate				
Groundwater	No further impacts envisaged					
Surface water	No further impacts envisaged					
Heritage	No further impacts envisaged					
Air Quality	Fugitive dust emissions from the exposed surface area, and vehicle movement will negatively affect the air quality	12 Moderate (-)	A dust management programme will be investigated and implemented.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractors responsibility.	Prior to construction	Project Manager
			Dust suppression techniques will be investigated and implemented.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractors responsibility.	Prior to construction	Project Manager
				Include the dust suppression techniques as part of the dust management plan within the construction activities	Prior to construction	Project Manager
			Roads will be treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	During construction	Project Manager
			Speed restrictions will be implemented to manage road usage.	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	During construction	Project Manager
	With management measures	6 Low (-)				
Visual	Increase in dust could lead to	9 Low to	Roads will be treated or surfaced in order	Include the dust suppression techniques as	Prior to	Project

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	a negative visual impact.	Moderate (-)	to reduce the impact of dust on the aesthetics of the surrounding area.	part of the dust management plan within the construction activities	construction	Manager
	With management measures	4 Low (-)				
Noise	An increase in ambient noise levels will be experienced by the movement of vehicles on the access and haul roads.	9 Low to Moderate 9-)	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	All contractors to supply a pre-planned maintenance plan for vehicles and equipment.	Prior to construction	Project Manager
			Vehicles will be equipped with mufflers where practical to reduce the emission of noise.	Regular audits/check to be done on vehicles and equipment.	During construction	Project Manager
	With management measures	5 Low (-)				
Socio-economic	No further impacts envisaged					

10.1.1.2 Establishment of Infrastructure

Once the area has been prepared the establishment of infrastructure will commence. The generation of waste (construction waste and general waste), and staff on site is also associated with the establishment of infrastructure.

Table 10-7: Cumulative impacts as a result of the establishment of infrastructure

Aspect	Direct Impact	Indirect and Cumulative Impacts
Construction of infrastructure	Soil compaction Loss of soil resource and associated erosion Vegetation destruction Loss of faunal habitat Visual impact Noise generation Fugitive dust generation	Loss of land capability Alien vegetation establishment
Waste generation (construction waste and general waste)	Soil pollution Visual impact Loss of faunal habitat	None
Staff on site (this section is discussed in Table 9-15 as a general aspect throughout the construction activities)	Influx of job seekers Harvesting of plants Poaching of animals Pollution due to incorrect disposal of domestic waste	Demographic and cultural problems

Table 10-8: Environmental impact significance rating and management measures associated with the construction of infrastructure

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Topography	No further impacts envisaged as the landscaping activities would have made provision for the topographic requirements.					
Soils and Land Capability	The construction of infrastructure will detrimentally alter the land capability of the area.	14 Moderate	Construction activities should be limited to the designated areas. No related activities may be undertaken outside of the designated areas.	Draw up a plan clearly defining the construction area.	Prior to construction	Project Manager
			The boundaries will be fenced off to prevent unnecessary impacts on surrounding land capabilities.	Draw up a plan clearly defining the construction area.	Prior to construction	Project Manager
			All fences will be routinely inspected and maintained.	Draw up a fence inspection protocol, and implement it.	During construction	Project Manager
			The surrounding land (not used for mining or operational purposes) will be kept in the state it was prior to the mining related construction activities.	Workers should complete induction prior to construction activities being undertaken.	Prior to construction	Project Manager
	With management measures	12 Moderate				
Flora	No further impacts envisaged					
Fauna	No further impacts envisaged					
Groundwater	No further impacts envisaged					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Surface Water	No further impacts envisaged					
Heritage	No further impacts envisaged					
Air Quality	Fugitive dust emissions from the exposed surface area, and vehicle movement will negatively affect the air quality	12 Moderate (-)	A dust management programme will be investigated and implemented.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	Prior to construction	Project Manager
			Dust suppression techniques will be investigated and implemented.	Include the dust suppression techniques as part of the dust management plan within the construction activities	Prior to construction	Project Manager
			Roads will be maintained, treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.	Monitor and ensure that the dust suppression is well managed.	During construction	Project Manager
	With management measures	6 Low (-)				
Visual	Increase in dust could lead to a negative visual impact.	9 Low to Moderate (-)	Roads will be treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.	Monitor and ensure that the dust suppression is well managed.	During construction	Project Manager
	With management measures	4 Low (-)				
Noise	Construction activities will increase the ambient noise levels in the area. The	9 Low to Moderate 9-)	All vehicles and equipment (especially diesel powered equipment) will be serviced	All contractors to supply a pre-planned maintenance plan for vehicles and equipment.	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	increase in noise is however temporary.		regularly and be kept in good working order.			
			Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	Regular audits/check to be done on vehicles and equipment.	During construction	Project Manager
	With management measures	5 Low (-)				
Socio-economic	No further impacts envisaged					

Table 10-9: Environmental impact significance rating and management measures associated with construction waste generation

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					
Topography	No further impacts envisaged					
Soils and Land Capability	The generation of waste may lead to soil contamination	10 Low to Moderate (-)	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.	Workers should complete induction prior to construction activities being undertaken.	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			Waste management will form a detailed component as part of the induction process provided by the mine.	Draw up a detailed waste management strategy	Prior to construction	Project Manager
				Draw up a waste management plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	Prior to construction	Project Manager
				Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Prior to construction	Project Manager
				Brief contractors as to the waste management plan and ensure it is enforced.	Prior to construction	Project Manager
			The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,	Draw up a waste management plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	Prior to construction	Project Manager
	With management measures	4 Low (-)				
Flora	The generation and improper	10 Low to	A detailed waste management	Workers should complete	Prior to	Project

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	disposal of waste could impact local ecosystem function	Moderate (-)	strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.	induction prior to construction activities being undertaken.	construction	Manager
				Draw up a detailed waste management strategy	Prior to construction	Project Manager
			The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner.	Draw up a waste management plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	Prior to construction	Project Manager
			Waste management will form a detailed component as part of the induction process provided by the mine.	Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Prior to construction	Project Manager
				Brief contractors as to the waste management plan and ensure it is enforced.	Prior to construction	Project Manager
	With management measures	4 Low (-)				
Fauna	The generation and improper disposal of waste could impact local ecosystem function	10 Low to Moderate (-)	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These	Workers should complete induction prior to construction activities being undertaken.	Prior to construction	Project Manager
				Draw up a detailed waste	Prior to	Project

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			containments will be colour coded.	management strategy	construction	Manager
			The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,	Draw up a waste management plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	Prior to construction	Project Manager
			Waste management will form a detailed component as part of the induction process provided by the mine.	Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Prior to construction	Project Manager
				Brief contractors as to the waste management plan and ensure it is enforced.	Prior to construction	Project Manager
	With management measures	4 Low (-)				
Groundwater	The leachate from waste storage sites may cause groundwater contamination	8 Low to Moderate (-)	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.	Workers should complete induction prior to construction activities being undertaken.	Prior to construction	Project Manager
				Draw up a detailed waste management strategy	Prior to construction	Project Manager
			The mine will adopt a cradle-to-	Draw up a waste management	Prior to	Project

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,	plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	construction	Manager
			Waste management will form a detailed component as part of the induction process provided by the mine.	Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Prior to construction	Project Manager
				Brief contractors as to the waste management plan and ensure it is enforced.	Prior to construction	Project Manager
			A groundwater monitoring programme will be developed and implemented.	Update the existing groundwater monitoring programme	During construction	Environmental Coordinator
			Boreholes will be monitored for groundwater level and quality on a quarterly basis.	Update the existing groundwater monitoring programme to include groundwater level monitoring	During construction	Environmental Coordinator
	With management measures	3 Low (-)				
Surface	No further impacts envisaged					
Heritage	No further impacts envisaged					
Air Quality	No further impacts envisaged					
Visual	Waste accumulation may have a	10 Low to	A detailed waste management	Workers should complete	Prior to	Project

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	negative visual impact	Moderate (-)	strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.	induction prior to construction activities being undertaken.	construction	Manager
				Draw up a detailed waste management strategy	Prior to construction	Project Manager
			The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,	Draw up a waste management plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	Prior to construction	Project Manager
			Waste management will form a detailed component as part of the induction process provided by the mine.	Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Prior to construction	Project Manager
				Brief contractors as to the waste management plan and ensure it is enforced.	Prior to construction	Project Manager
	With management measures	4 Low (-)				
Noise	No further impacts envisaged					
Socio-economic	No further impacts envisaged					

Table 10-10: Environmental impact significance rating and management measures associated with staff on site

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impact envisaged					
Topography	No further impact envisaged					
Soils and Land Capability	No further impact envisaged					
Flora and Fauna	Increased harvesting and poaching of local fauna and flora	9 Low to Moderate (-)	The poaching and hunting of animals will be strictly forbidden.	Ensure the environmental awareness plan is updated annually.	Annually	Environmental Coordinator
			Workers will be restricted to construction and operational areas.	Brief employees on the Environmental Awareness plan and enforce the implementation thereof.	During construction & Operation	Environmental Coordinator
			All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will form part of the environmental awareness plan.	Brief employees on the Environmental Awareness plan and enforce the implementation thereof.	Ongoing	Environmental Coordinator
			Off-limit areas will be fenced off.	Fence off off-limit areas	Prior to construction	Project Manager
			Penalties will be imposed on all staff that unnecessarily damages any environmental parameters.	Implement a penalty system for non compliance to the Environmental Awareness Plan	Ongoing	Environmental Coordinator
			Strict penalties for non-conformance will be enforced.	Implement a penalty system for non compliance to the Environmental	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
				Awareness Plan		
	With management measures	5 Low (-)				
Groundwater	No further impact envisaged					
Surface Water	Workers may directly impact surface water through improper waste disposal and not using sanitation facilities.	9 Low to Moderate (-)	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.	Draw up a detailed waste management strategy	Prior to construction	Environmental Coordinator
				Draw up a waste management plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	Prior to construction	Environmental Coordinator
			Waste management will form a detailed component as part of the induction process provided by the mine.	Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Prior to construction	Environmental Coordinator
			The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,	Brief contractors as to the waste management plan and ensure it is enforced.	Prior to construction	Environmental Coordinator
			Workers will be restricted to construction / operational areas.	Draw up a plan clearly defining the construction area.	Prior to construction	Environmental Coordinator
			All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will	Brief employees on the Environmental Awareness plan and enforce the implementation thereof.	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			form part of the environmental awareness.			
			Access on site will be restricted to operational areas.	Draw up a plan clearly defining the operational area.	Prior to operation	Environmental Coordinator
	With management measures	5 Low (-)				
Heritage	Damage to possible graves may be caused by workers on site.	15 Moderate (-)	Access on site will be restricted to construction and operational areas.	Draw up a plan clearly defining the operational area.	Prior to operation	Environmental Coordinator
	With management measures	13 Moderate (-)				
Air Quality	No further impact envisaged					
Visual	No further impact envisaged					
Noise	No further impact envisaged					
Socio-economic	Sustainable job creation as a result of the current and future mining activities.	15 Moderate (+)	The provisions outlined in the social and labour plan will be implemented			
	With management measures	Moderate (+)				
	Staff leaving gates open may lead to cattle leaving the farms.	11 Moderate (-)	Good housekeeping practices will be taught through induction and implemented throughout the construction, operational, decommissioning and closure phases.	Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	With management measures	8 Low to Moderate (-)				

10.1.2 Operational Phase

10.1.2.1 Mining and extraction of resources

Table 10-11: Impacts as a result of mining and extraction of resources

Aspect	Direct Impact	Indirect and Cumulative Impacts
Operation of loading and hauling vehicles on site	Dust generation Soils pollution due to hydrocarbon spills	Noise generation Visual impact

Table 10-12: Environmental impact significance rating and management measures associated with loading and hauling vehicles

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
Geology	No further impacts envisaged					
Topography	No further impacts envisaged					
Soils and Land	Soil pollution due to the	9 Low to	Employees will be educated by means	All spills are to be recorded and	Ongoing	Environmental

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
Capability	spillage of hydrocarbons on the mining site.	Moderate (-)	of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.	reported.		Coordinator
				Draw up a procedure to ensure all hazardous spills will be dealt with within 24 hours of occurrence.	Ongoing	Environmental Coordinator
				Brief contractors on the procedure for dealing with hazardous spillages and ensure their understanding and implementation thereof.	Ongoing	Environmental Coordinator
				Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Ongoing	Environmental Coordinator
			The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.	Ensure the Emergency Preparedness and Response programme is up to date.	Ongoing	Environmental Coordinator
				Brief contractors on the Emergency Preparedness and Response programme and enforce the implementation thereof.	Ongoing	Environmental Coordinator
			No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.	Draw up a comprehensive Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or used on site.	Ongoing	Environmental Coordinator
				All MSDS's must be displayed where hydrocarbons and/or chemicals are	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
				stored and utilised.		
				Brief all contractors on the location of the MSDS and how this should be utilised.	Ongoing	Environmental Coordinator
	With management measures	7 Low to Moderate (-)		Draw up a comprehensive Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or used on site.	Ongoing	Environmental Coordinator
Flora	Windblown dust from the roads could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant vigour.	15 Moderate	A dust monitoring programme will be investigated and implemented.	Update the dust management plan and implement.	Ongoing	Environmental Coordinator
			Dust must be suppressed by using a dust suppression method.	Include the dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
	With management measures	12 Low to moderate				
	The presence of disturbed land could allow the establishment of alien invasive vegetation	13 Moderate (-)	The mine will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions.	Draw up an eradication, spread prevention as well as monitoring plan for invader species.	Ongoing	Environmental coordinator
				Implement the plan and monitor the area	Ongoing	Environmental coordinator
	With management measures	6 Low (-)				
Fauna	Noise could have an impact					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
	on animals in the area (Refer to noise management measures in table).					
Groundwater	No further impacts envisaged					
Surface water	No further impacts envisaged					
Heritage	No further impacts envisaged					
Air Quality	Fugitive dust emissions from the exposed surface area, and vehicle movement will negatively affect the air quality	15 Moderate (-)	A dust management programme will be investigated and implemented.	Update the dust management plan and implement.	Ongoing	Environmental Coordinator
			Dust suppression techniques will be investigated and implemented.	Include the dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
			Speed restrictions will be implemented to manage fugitive dust emissions from road usage.	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	Ongoing	Environmental Coordinator
	With management measures	10 Low to Moderate (-)				
Visual	No further impacts envisaged					
Noise	An increase in ambient noise levels will be experienced by the movement of vehicles on the access and haul roads.	8 Low to Moderate (-)	All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order.	Regular audits/check to be done on vehicles and equipment.		

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
			Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	All contractors to supply a pre-planned maintenance plan for vehicles and equipment.	Prior to construction	Project Manager
			Vehicles will be equipped with mufflers where practical to reduce the emission of noise.	Regular audits/check to be done on vehicles and equipment.	During construction	Project Manager
	With management measures	5 Low (-)				
Socio-economic	No further impacts envisaged					

10.1.2.2 Processing of resources

Table 10-13: Impacts as a result of the processing of resources

Aspect	Direct Impact	Indirect and Cumulative Impacts
Operation of the processing plant	Dust generation Soil pollution due to hydrocarbon spills	Noise generation Visual Impact
Handling of plant	Possible groundwater and surface	Possible deterioration of water quality outside mining area

Aspect	Direct Impact	Indirect and Cumulative Impacts
residue and dirty water	water pollution Possible soil contamination	Loss of ecological function in surface water bodies outside of the mining area.
Product stockpiles	Stockpiles will alter the topography of the site Runoff from stockpiles may remove material and flow into existing surface water resulting in the siltation thereof Deterioration of surface water due to diffuse pollution The stockpiles will have a visual impact Noise will be produced during the stockpiling process The stockpiling process will create fugitive dust emissions	Possible deterioration of water quality outside mining area Fugitive dust emissions may create a visual impact

Table 10-14: Environmental impact significance rating and management measures associated with the operation of the plant

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
Geology	No further impacts envisaged					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
Topography	No further impacts envisaged					
Soils and Land Capability	Soil pollution due to possible spillages of hydrocarbons during processing.	9 Low to Moderate (-)	Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.	All spills are to be recorded and reported.	Ongoing	Environmental Coordinator
				Draw up a procedure to ensure all hazardous spills will be dealt with within 24 hours of occurrence.	Ongoing	Environmental Coordinator
				Brief contractors on the procedure for dealing with hazardous spillages and ensure their understanding and implementation thereof.	Ongoing	Environmental Coordinator
				Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Ongoing	Environmental Coordinator
			The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.	Ensure the Emergency Preparedness and Response programme is up to date.	Ongoing	Environmental Coordinator
				Brief contractors on the Emergency Preparedness and Response programme and enforce the implementation thereof.	Ongoing	Environmental Coordinator
			No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed	Draw up a comprehensive Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or used on site.	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
			contained area.	All MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised.	Ongoing	Environmental Coordinator
				Brief all contractors on the location of the MSDS and how this should be utilised.	Ongoing	Environmental Coordinator
	With management measures	7 Low to Moderate (-)		Draw up a comprehensive Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or used on site.	Ongoing	Environmental Coordinator
Flora	Windblown dust from the processing could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant vigour.	13 Moderate	A dust monitoring programme will be investigated and implemented.	Update the dust management plan and implement.	Ongoing	Environmental Coordinator
			Dust must be suppressed by using a dust suppression method.	Include the dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
	With management measures	8 Low to moderate				
Fauna	No further impacts envisaged					
Groundwater	No further impacts envisaged					
Surface water	No further impacts envisaged					
Heritage	No further impacts envisaged					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
Air Quality	Dust emissions from processing will negatively affect the air quality.	13 Moderate (-)	A dust management programme will be investigated and implemented.	Update the dust management plan and implement.	Ongoing	Environmental Coordinator
			Dust suppression techniques will be investigated and implemented.	Include the dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
	With management measures	10 Low to Moderate (-)				
Visual	Dust emissions from processing plant will have visual impacts (visual intrusion, visibility and visual exposure).	8 Low to Moderate	A dust management programme will be investigated and implemented.	Update the dust management plan and implement.	Ongoing	Environmental Coordinator
			Dust suppression techniques will be investigated and implemented.	Include the dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
	With management measures	5 Low (-)				
Noise	An increase in ambient noise levels will be experienced by the movement of vehicles on the access and haul roads.	8 Low to Moderate (-)	All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order.	Regular audits/check to be done on vehicles and equipment.		
			Where noise becomes a nuisance, management measures will be investigated and implemented to	All contractors to supply a pre-planned maintenance plan for vehicles and equipment.	Prior to construction	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Responsible Person	Frequency
			address these.			
	With management measures	5 Low (-)				
Socio-economic	No further impacts envisaged					

Table 10-15: Environmental impact significance rating and management measures associated with the handling of plant residue and dirty water

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					
Topography	Stockpiles will alter the topography of the area.	14 Moderate	Product and waste rock stockpile size will be kept to minimum and will be removed on a continuous basis.	Loading and hauling vehicles will remove stockpiles on a continuous basis	Ongoing	Environmental Coordinator
			Stockpiles will be kept in demarcated areas.	Ensure that the design drawing indicate where these areas will be located	Ongoing	Environmental Coordinator
	With management measures	9 Low to Moderate(-)				
Soils and Land Capability	Leachage from the waste and dirty control dams could adversely affect the soil quality	14 Moderate (-)	The water storage facilities will be regularly monitored for leaks and siltation and will be adequately maintained.	Refer to surface water management measures		
			A detailed surface water monitoring programme will be implemented.	Refer to surface water management measures		

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	With management measures	7 Low to Moderate (-)				
Flora	No further impacts envisaged					
Fauna	No further impacts envisaged					
Surface Water	Leaking storage facilities will result in a loss of water and will impact the water availability of the mine.	11 Moderate (-)	The water storage facilities will be regularly monitored for leaks and siltation and will be adequately maintained.	Draw up a monitoring plan, implement and maintain.	Ongoing	Environmental Coordinator
			A detailed surface water monitoring programme will be implemented.	Update the detailed surface and ground water monitoring programme	Ongoing	Environmental Coordinator
			Dirty water dams will be lined by a suitable liner to limit the potential for leakage.	Line dirty water dams in the prescribed manner, monitor and maintain.	Ongoing	Environmental Coordinator
	With management measures	7 Low to Moderate (-)				
Heritage	No further impacts envisaged					
Air Quality	No further impacts envisaged					
Visual	No further impacts envisaged					
Noise	No further impacts envisaged					
Socio-economic	No further impacts envisaged					

Table 10-16: Environmental impact significance rating and management measures associated with product and waste rock stockpiles

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					
Topography	Stockpiles will alter the topography of the area.	14 Moderate	Product and waste rock stockpile size will be kept to minimum and will be removed on a continuous basis.	Loading and hauling vehicles will remove stockpiles on a continuous basis	Ongoing	Environmental Coordinator
			Stockpiles will be kept in demarcated areas.	Ensure that the design drawing indicate where these areas will be located	Ongoing	Environmental Coordinator
		9 Low to Moderate				
Soils and Land Capability	No further impacts envisaged.					
Flora	No further impacts envisaged					
Fauna	No further impacts envisaged					
Groundwater	The stockpiling of material may lead to a decrease in groundwater quality through the infiltration of contaminated water.	9 Low to Moderate (-)	A groundwater monitoring procedure will be investigated and implemented.	Update the detailed groundwater monitoring procedure	Ongoing	Environmental coordinator
			Boreholes will be monitored for	Update the detailed groundwater	Ongoing	Environmental

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			groundwater level and quality	monitoring procedure		coordinator
			Should the groundwater monitoring reveal that the quality of groundwater available to surrounding users is affected due to mining activities; an alternative water resource will be provided to replace the loss.	Ongoing groundwater monitoring to be conducted by the mine (groundwater quality and levels)	Ongoing	Environmental Coordinator
			Uncontrolled stockpiling of product will be avoided and cleaned up immediately when detected.	Ensure stockpiling procedure is effective, monitor and maintain.	Ongoing	Environmental Coordinator
			The product and waste rock stockpiles should be kept as small as possible. This will reduce the volume of potentially poor quality leachate infiltrating the aquifers. The base of the product stockpile should be compacted to reduce the permeability and therefore the infiltration.	Ensure stockpiling procedure is effective, monitor and maintain.	Ongoing	Environmental Coordinator
	With management measures	7 Low to Moderate (-)				
Surface Water	Runoff from stockpiles will flow into non-perennial rivers especially during intensive	9 Low to Moderate (-)	Berms, should they be necessary, will be constructed upstream and downstream of the dumps and	Monitor and maintain the clean an dirty water separation	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	rainstorms.		stockpiles to ensure that clean water is kept separate from dirty water. Water contained in the berms downstream will evaporate.	infrastructure		
			All berms will be sized so as to prevent spilling for up to a 1:50 year storm event.	Monitor and maintain the clean an dirty water separation infrastructure	Ongoing	Environmental Coordinator
			The dumps will be constructed in such a way that dust and water erosion is limited.	Monitor and maintain the clean an dirty water separation infrastructure	Ongoing	Environmental Coordinator
			Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down	Monitor and maintain the clean an dirty water separation infrastructure	Ongoing	Environmental Coordinator
	With management measures	7 Low to Moderate (-)				
Heritage	No significant impact					
Air Quality	Fugitive dust emissions from the stockpiles will have a negative visual impact	12 Moderate (-)	A dust monitoring and management programme will be investigated and implemented.	Update the dust management plan	Ongoing	Environmental Coordinator
			Dust suppression techniques will be investigated and implemented.	Include dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			Should it be found that the stockpiles create excessive dust, measures must be implemented to reduce this impact.		Ongoing	Environmental Coordinator
	With management measures	8 Low to Moderate (-)				
Visual	The removal, transportation and stockpiling of material will have a visual impact	12 Moderate (-)	Stockpile heights will be restricted as far as practically possible.	Ensure stockpiling procedure is effective, monitor and maintain.	Ongoing	Environmental Coordinator
			Stockpile will only be placed within the designated mine area boundaries.	Ensure stockpiling procedure is effective, monitor and maintain.	Ongoing	Environmental Coordinator
			The visual management measures as incorporated during the construction phase will be maintained during the operational phase.	Ensure stockpiling procedure is effective, monitor and maintain.	Ongoing	Environmental Coordinator
	With management measures	8 Low to Moderate (-)				
Noise	No further impacts envisaged					
Socio-economic	No further impacts envisaged					

10.1.2.3 Transporting of raw material, product and waste

Table 10-17: Impacts as a result of transporting of raw material, product and waste

Aspect	Direct Impact	Indirect and Cumulative Impacts
Movement of vehicles on gravel access and haul roads	Visual impact Deterioration of gravel roads Soils pollution due to hydrocarbon spills Noise generation Dust generation	Dust impacting flora Disturbance of local people (if applicable)

Table 10-18: Environmental impact significance rating and management measures associated with transporting of raw material, product and waste

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					
Topography	No further impacts envisaged					
Soils and Land capability	Soil pollution due to the spillages of hydrocarbons along the access and haul routes	9 Low to Moderate (-)	Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the	All spills are to be recorded and reported.	Ongoing	Project Manager
				Draw up a procedure to ensure all	Ongoing	Project

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			implementation of good housekeeping practices.	hazardous spills will be dealt with within 24 hours of occurrence.		Manager
				Brief contractors on the procedure for dealing with hazardous spillages and ensure their understanding and implementation thereof.	Ongoing	Project Manager
				Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Ongoing	Project Manager
			The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.	Ensure the Emergency Preparedness and Response programme is up to date.	Ongoing	Project Manager
				Brief contractors on the Emergency Preparedness and Response programme and enforce the implementation thereof.	Ongoing	Project Manager
			No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.	Draw up a comprehensive Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or used on site.	Ongoing	Project Manager
				All MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised.	Ongoing	Project Manager
				Brief all contractors on the location of the MSDS and how this should be utilised.	Ongoing	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	With management measures	6 Low				
Flora	Windblown dust from the roads could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant vigour.	12 Moderate	A dust management programme will be investigated and implemented.	Update the dust management plan and implement.	Ongoing	Environmental Coordinator
			Dust suppression techniques will be investigated and implemented.	Include the dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
	With management measures	6 Low				
Fauna	No further impacts envisaged					
Groundwater	No further impacts envisaged					
Surface water	The presence of linear infrastructure could lead to an increase in volume and speed of surface water run-off which will increase the erosive capacity of the water. This is due to channelling of water along the road surface.	13 Moderate	Roads will be maintained throughout the life of mine on a continuous basis.	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	Ongoing	Project Manager
			Roads will be maintained, treated or surfaced with gravel in order to reduce the impact of water run-off	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	Ongoing	Project Manager
			Berms, should they be necessary will be constructed next to the road to reduce surface water runoff.	Ensure the required erosion protection measures are maintained, monitored and corrected where necessary.	Ongoing	Project Manager
		6 Low				

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Heritage	No further impacts envisaged					
Air Quality	Dust emissions from vehicle movement and operation will negatively affect the air quality.	12 Moderate (-)	A dust management programme will be investigated and implemented.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractors responsibility.	Ongoing	Project Manager
			Dust suppression techniques will be investigated and implemented.	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractors responsibility.	Ongoing	Project Manager
				Include the dust suppression techniques as part of the dust management plan within the construction activities	Ongoing	Project Manager
			Roads will be treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	Ongoing	Project Manager
			Speed restrictions will be implemented to manage road usage.	Vehicles will remain within a speed limit of 40km/h on unsurfaced or gravel roads.	Ongoing	Project Manager
	With management measures	6 Low (-)				
Visual	The access and haul roads will have visual impacts (visual intrusion, visibility and visual exposure).	8 Low to Moderate (-)	Roads will be treated or surfaced in order to reduce the impact of dust on the aesthetics of the surrounding area.	Include the dust suppression techniques as part of the dust management plan within the construction activities	Ongoing	Project Manager

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	With management measures	5 Low (-)				
Noise	An increase in ambient noise levels will be experienced by the movement of vehicles on the access and haul roads.	9 Low to Moderate 9-)	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	All contractors to supply a pre-planned maintenance plan for vehicles and equipment.	Ongoing	Project Manager
			All vehicles and equipment (especially diesel powered equipment) will be serviced regularly and be kept in good working order.	Regular audits/check to be done on vehicles and equipment.	Ongoing	
			Vehicles will be equipped with mufflers where practical to reduce the emission of noise.	Regular audits/check to be done on vehicles and equipment.	Ongoing	Project Manager
	With management measures	5 Low (-)				
Socio-economic	No further impacts envisaged					

10.1.2.4 Waste rock dump disposal

Table 10-19: Impacts as a result of the waste rock disposal facility

Aspect	Direct Impact	Indirect and Cumulative Impacts
Development of waste rock disposal facility	Runoff from waste rock dumps may remove material and flow into existing non-perennial	Topographical alterations

Aspect	Direct Impact	Indirect and Cumulative Impacts
	surface water resulting in the siltation thereof The waste rock dumps will have a visual impact Noise will be produced during the waste rock dumping process The waste rock dumping process will create fugitive dust emissions	Deterioration of water quality Fugitive dust emissions may create a visual impact

Table 10-20: Environmental impact significance rating and management measures associated with the development of a waste rock disposal facility

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					
Topography	No further impacts envisaged					
Soils and Land Capability	No further impacts envisaged					
Flora	Windblown dust from the roads could prohibit the photosynthesis process in plants. This could cause reduced growth rates and plant	13 Moderate (-)	A dust monitoring programme will be investigated and implemented.	Update the dust management plan and implement.	Ongoing	Environmental Coordinator
			Dust suppressed must be	Include the dust suppression	Ongoing	Environmental

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	vigour.		implemented.	techniques as part of the dust management plan		Coordinator
	With management measures	7 Low to moderate (-)				
Fauna	No further impacts envisaged					
Groundwater	No further impact envisaged					
Surface Water	Runoff from the co-disposal facility will flow into pans and other watercourses especially during intensive rainstorms. This results in siltation, which adversely affects the water quality as well as the habitat of the living organisms.	9 Low to Moderate (-)	Berms, should they be necessary, will be constructed upstream and downstream of the co-disposal facility to ensure that clean water is kept separate from dirty water. Water contained in the berms downstream will evaporate.	Monitor and maintain the clean an dirty water separation infrastructure	Ongoing	Environmental Coordinator
			All berms will be sized so as to prevent spilling for up to a 1:50 year storm event.	Monitor and maintain the clean an dirty water separation infrastructure	Ongoing	Environmental Coordinator
			Dumps will be removed on a continuous basis and dumped into the historical open cast pits. This will keep the dumps to a minimal size.	Loading and hauling vehicles will remove stockpiles on a continuous basis	Ongoing	Environmental Coordinator
			The dumps will be constructed in such a way that dust and water	Maintain and monitor the clean and dirty water separation	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			erosion is limited.	infrastructure		
			Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down.	Maintain and monitor the clean and dirty water separation infrastructure	Ongoing	Environmental Coordinator
	With management measures	13 Moderate (-)				
Heritage	No significant impact					
Air Quality	Fugitive dust emissions from the co-disposal facility will have a negative visual impact	12 Moderate (-)	A dust monitoring and management programme will be investigated and implemented.	Update the dust management plan	Ongoing	Environmental Coordinator
			Dust suppression techniques will be investigated and implemented.	Include dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
			Should it be found that the stockpiles create excessive dust, measures must be implemented to reduce this impact.	Include dust suppression techniques as part of the dust management plan	Ongoing	Environmental Coordinator
	With management measures	8 Low to Moderate (-)				
Visual	The removal, transport and storage of discard material will have a visual	15 Moderate (-	Discard dump heights will be	Loading and hauling vehicles will remove stockpiles on a continuous	Ongoing	Environmental

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	impact (visual intrusion, visibility and visual exposure of discard dumps)	)	restricted	basis		Coordinator
			Discard dumps will only be placed within the mine area boundaries.	Ensure that the design drawing indicate where these areas will be located	Ongoing	Environmental Coordinator
			Indigenous trees will be planted as barriers between the facilities and visually sensitive areas.	Plant indigenous trees as required	Ongoing	Environmental Coordinator
			Dumps will be removed on a continuous basis and dumped into the historical open cast pits. This will keep the dumps to a minimal size and amount	Loading and hauling vehicles will remove stockpiles on a continuous basis		
	With management measures	8 Low to Moderate (-)				
Noise	No further impact envisaged					
Socio-economic	No further impact envisaged					

10.1.2.5 Domestic waste and hazardous waste disposal

Table 10-21: Impacts as a result of domestic waste and hazardous waste disposal

Aspect	Direct Impact	Indirect and Cumulative Impacts
Generation and disposal of domestic and general waste	Surface water and soil contamination Waste accumulation may have a negative visual impact The generation and improper disposal of waste may impact upon ecosystem function Domestic waste accumulation may attract pest faunal species	Contaminated soils and surface water may have ecological implications Contamination of water may present a health risks to local people and fauna
Storage, handling and disposal of hydrocarbons (Refer to	Contamination of soils, surface water and groundwater due to spills or improper disposal Potential fires fuelled by combustible hydrocarbons may create risks for people, fauna and flora	Contaminated soils and water may impact on local ecology

Table 10-22: Environmental impact significance rating and management measures associated with waste generation

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Topography	No further impacts envisaged					
Soils and Land Capability	The generation of waste may lead to soil contamination	9 Low to Moderate (-)	A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste types. These containments will be colour coded.	Update the waste management plan that will ensure that recycling takes place and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site	Ongoing	Environmental coordinator
			Waste management will form a detailed component as part of the induction process provided by the mine.	Brief employees as to the waste management plan and ensure it is enforced.	Ongoing	Environmental coordinator
			The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed and correct manner,	Draw up and enforce site rules for employees to ensure good housekeeping practices.	Ongoing	Environmental coordinator
	With management measures	4 Low (-)				
Flora	The generation and improper disposal of waste could impact local ecosystem function	9 Low to Moderate (-)	Please refer to the management measures above.			
	With management measures	4 Low (-)				
Fauna	The generation and improper	9 Low to	Please refer to the management			

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
	disposal of waste could impact on fauna as it could impact on the habitats, but the waste can also be consumed which could lead to diseases.	Moderate (-)	measures above.			
	With management measures	4 Low (-)				
Groundwater	The leachate from waste storage sites may cause groundwater contamination	9 Low to Moderate (-)	Please refer to the management measures above.			
			A groundwater monitoring programme will be developed and implemented.	Update and implement the groundwater monitoring programme	Ongoing	Environmental coordinator
			Boreholes will be monitored for groundwater level and quality	Update and implement the groundwater monitoring programme	Ongoing	Environmental coordinator
	With management measures	4 Low (-)				
Surface Water	The generation of waste may lead to surface water contamination	9 Low to Moderate (-)	Please refer to the management measures above.			
			A surface water monitoring programme will be developed and implemented	Update and implement the surface water monitoring programme	Ongoing	Environmental coordinator
	With management measures	4 Low (-)				
Heritage	No further impacts envisaged					

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Air Quality	No further impacts envisaged					
Visual	Waste accumulation may have a negative visual impact	10 Low to Moderate (-)	Please refer to the management measures above.			
	With management measures	4 Low (-)				
Noise	No further impacts envisaged					
Socio-economic	No further impacts envisaged					

Table 10-23: Environmental impact significance rating and management measures associated with the storage, handling and disposal of hydrocarbons (HCS)

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
Geology	No further impacts envisaged					
Topography	No further impacts envisaged					
Soils and Land Capability	The use of diesel, oil and other hazardous chemical substances may lead to the contamination of soils.	12 Low to Moderate	All hydrocarbons should be stored in designated, bunded areas with a capacity of at least 110% of the volume stored.	Draw-up and enforce site rules for employees to ensure good housekeeping practices	Ongoing	Environmental Coordinator
			Spill kits should be readily available and all employees must	All spills are to be recorded and reported.	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			be trained in the utilisation thereof.			
			Should a spill take place the area should be cleaned immediately and the contaminated area will be rehabilitated as appropriate.	Draw up a procedure to ensure all hazardous spills will be dealt with within 24 hours of occurrence.	Ongoing	Environmental Coordinator
			Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.	Brief employees on the Environmental Awareness Plan and enforce the implementation thereof.	Ongoing	Environmental Coordinator
				Implement a penalty system for non compliance to the Environmental Awareness Plan.	Ongoing	Environmental Coordinator
				Draw up and enforce site rules for contractors to ensure good housekeeping practices.	Ongoing	Environmental Coordinator
			The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.	Ensure the Emergency Preparedness and Response programme is up to date.	Ongoing	Environmental Coordinator
				Brief contractors on the Emergency Preparedness and Response programme and enforce the implementation thereof.	Ongoing	Environmental Coordinator

Environmental Parameter	Impact Description	Significance	Management Measures	Action Plan	Frequency	Responsible Person
			In the event of a major spill that could result in major soil and water contamination the DWAF should be informed immediately and a remediation strategy should be enforced.	Draw up a procedure to ensure all hazardous spills will be dealt with within 24 hours of occurrence.	Ongoing	Environmental Coordinator
			The management of chemicals and hydrocarbons should form part of the emergency preparedness and response programme.	Ensure the Emergency Preparedness and Response programme is up to date.	Ongoing	Environmental Coordinator
				Brief contractors on the Emergency Preparedness and Response programme and enforce the implementation thereof.	Ongoing	Environmental Coordinator
			No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.	Draw up a comprehensive Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or used on site.	Ongoing	Environmental Coordinator
				All MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised.	Ongoing	Environmental Coordinator
				Brief all contractors on the location of the MSDS and how this should be utilised.	Ongoing	Environmental Coordinator