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Final Scoping report as part of the Environmental Impact Assessment for the Proposed New HEF Plant on Sishen Iron Ore Mine at Kathu, Northern Cape Province

June 2014

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Compiled by: C Da Camara

M Grobler

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Final Scoping report as part of the Environmental Impact Assessment for the Proposed New HEF Plant on Sishen Iron Ore Mine at Kathu, Northern Cape Province

June 2014

Prepared for:

Anglo American/ Sishen Iron Ore Mine

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Executive Summary

Introduction

AGES Gauteng was appointed by Sishen Iron Ore Mine to facilitate the Environmental Impact Assessment (EIA) process for the proposed new High Energy Fuel (HEF) Plant on Sishen Iron Ore Mine, Northern Cape Province.

The study area for the Sishen HEF Plant and Infrastructure Project occurs on the north-western outskirts of the Sishen Iron Ore Mine on Remaining Extent (RE) of Woon 469, RE/portion 1 of Sacha 468 and portion 11 of Sacha 468. The proposed project is located to the south west of the town of Kathu, on property of the Sishen Mine, and within the existing Mining Right area, Northern Cape Province of South Africa.

The project area is situated directly west of the old Transnet railway line which has recently been rerouted to run parallel to the Gamagara River to the west of the Sishen Iron Ore Mine. A number of small Endorheic depressions or Salt pans, the largest of which is Springbok Pan, occur in the general vicinity of the project area.

Environmental Impact Assessment Process

An Environmental Impact Assessment (EIA) is an essential planning tool for any development. It identifies the environmental impacts of a proposed project and assists in ensuring that a project will be environmentally acceptable and integrated into the surrounding environment in a sustainable way. To ensure that all requirements and processes in terms of the relevant Acts (mentioned under Section 3.1) are undertaken, the following tasks need to be conducted during the EIA process:

- **Environmental Scoping**. Initial Investigation, communication, assessment and consideration of application and potential environmental impacts and submission of an Environmental Scoping Report and Plan of Study for Environmental Impact Assessment.

- **Environmental Impact Assessment:** After the approval of the Scoping Report and Plan of study, further investigation of environmental impacts identified during the Scoping Phase will take place. An EIA Report and Environmental Management Plan (Programme) will then be submitted with these findings.

Public Participation:

The following process was undertaken to facilitate the public participation for the proposed project:

Newspaper Advertisement: An advertisement notifying the public of the EIA application and process and requesting I&AP's to register their comments with AGES Gauteng, was placed in the Kathu Gazette on the 23 November 2013.

Site notice: In order to inform surrounding communities and adjacent landowners of the proposed

development site notices boards where placed at the following locations on the 23 November 2013:

- Kathu Library
- Sishen mine entrance (Permit office)

Direct Notification of Identified I&Aps: Key stakeholders, who included the following sectors, were directly informed of the proposed project. A Background Information Document (BID) with a Registration and Comment Sheet were distributed with a notification letter to all identified stakeholders on 29 November 2013.

Draft Scoping Report: The EIA Regulations specify that I&APs must have an opportunity to verify that their issues have been captured. A period of 30 days was made available to allow for public comment on the draft Scoping Report. The availability of the draft Scoping Report was announced via personal notification letters, posters and/or sms to all the registered I&APs on the distribution list.

Project Description

Most of the High Energy Fuel (HEF) components are received from BME Group including Ammonium Nitrate Calcium Nitrate (AN/CN) solution. Emulsion explosives consist of distinct fuel/oil and oxidiser phases. They are popular because of the ability to transport and handle two non explosive phases until they are blended and pumped into the blast hole at the mine. Even when finally combined they only have a relatively low sensitivity and require a booster and confinement to ensure effective detonation. Two of the most notable physical chemical properties of emulsions are its water resistance and high bulk density. These properties also have advantages in minimizing environmental risks associated with manufacture and transportation.

The AN/CN solution will be transported in bulk carriers to the mine and stored in silos at the HEF plant. The Ammonium Nitrate Porous Prills1 (ANPP) used are manufactured by AEL Mining Services and transported to the mine in bulk carriers and via bottom dumper railway trucks and will be kept in a store with 3600 tons capacity.

Fluiden and used recycled oil will be used in the manufacturing of the HEF and will be transported to the mine in bulk carriers and stored in tanks within bunded areas.

The product is made by blending in a number of mixers and stored in various silos or tanks. Emulsion explosives consist of a blended fuel/oil phase and then a separately produced oxidizing phase (which is produced by the mixing of the “Gassing” materials including ammonium nitrite). These products are loaded separately into the different compartments of MMU’s (Mobile Manufacturing Units).

1 A **prill** is a small aggregate of a material, most often a dry sphere, formed from a melted liquid. **Prilled** is a term used in mining and manufacturing to refer to product that has been pelletized. The pellets are a neater, simpler form for handling, with reduced dust.

The HEF manufacturing facility will consist of:

- A HEF Plant:
    - A bulk storage facility for ANCN (Ammonium Nitrate Calcium Nitrate) ;
    - A bulk storage facility for recycled oil and fuel;
    - A store (drums and bags) for product storage (Thiouria, Sulphamic acid, Sodium nitrate, E23);
    - A store for spares and tyre storage;
    - A bulk storage facility for manufactured HEF;
    - A laboratory for quality control;
    - A weighbridge;
- Bulk ANPP storage facility;
- Explosives magazine facility;
- Administration building supporting the facilities;
- Ablution and change house facility;
- Wash bay facility;
- Calibration facility for explosives trucks;
- All infrastructure required in supporting the abovementioned facilities;
- Access road;
- A rail line for offloading ANPP; and
- Establishment of boreholes to monitor ground water quality

Baseline Environment

The description of the baseline environment of the proposed development sites was based on desktop-studies and available information as well as a number of specialist studies conducted for the project. The following specialist studies were undertaken:

- Heritage Assessment
- Ecological Assessment
- Hydrogeological Baseline Assessment (currently being undertaken).

Geology: The HEF plant project site is underlain by Kalahari sand, calcrete, clay, conglomerate, Dwyka Tillite and lava. The deeper located geologies is banded iron formation (BIF) and fine and coarse grained dolomite, chert and dolomitic limestone with prominent interbedded chert, limestone and banded ironstone with chert breccia capping the Ghaap Plateau Formation.

Regional Climate: In terms of the climatic region, the proposed project site falls within the Kalahari Bushveld Region (South African Weather Service, Climatic Regions). Climatic conditions consist of warm summers with moderate but very dry winters.

Topography and Drainage: The natural topography surrounding the Sishen Mine is generally flat with some isolated undulating areas. The average altitude of the flat plains is at 1200 metres above mean sea level. There are a number of hills, stretching up to 1350 metres above mean sea level, to the southeast of the Sishen mining areas, close to the N14 road. The natural topography of the site has been significantly altered as a result of historic and on-going mining activities. Currently, the existing mine infrastructure and activities dominate the landscape at Sishen, and the natural, relatively flat topography has been replaced by man-made topographical features.

Surface Water: The project area is situated within the quaternary catchment D41J, which is located in the Lower Vaal Water Management Area (WMA). There are no perennial rivers in the area. The local quaternary catchment D41J covers an area of 3 847 km2. The catchment system is endoreic with the Gamagara River flowing into the Kuruman River close to Hotazel. The only natural wetland areas in the project area described as Southern Kalahari Salt Pans (Mucina & Rutherford, 2006). This wetland type on site can be classified as a depression known as an endorheic pan.

Sishen Mine manages storm water runoff through an over-all storm water management master plan compiled for the mine in accordance with the relevant legislation. The HEF Plant project will have its own stormwater management plant to also comply with GN704.

Water Quality: The overall John Taolo Gaetsewe District Municipal area has good water quality due to the large area being underlain by dolomite, an aquifer with good storage and recharge capacity. Most of the domestic water used in the John Taolo Gaetsewe District Municipal Area is supplied to the area via the Vaal-Gamagara Government Water Supply Scheme, also known as the Kalahari East Pipeline.

Soil Types: The land type unit represented within the proposed footprint area include the Ag110 land type. The soils to the west of Kathu are shallow to very shallow with calcrete cropping out at the surface on the proposed development site in many places. The soils are therefore generally of the Mispah form in the study area. This region is not suited to the production of arable agricultural products owing to the low rainfall. Consequently there is no record of any significant form of agricultural production in this area. The shallow, rocky physical nature of the soil forms as well as the extremely high calcium and magnesium levels present, make the study site unsuitable for crop production.

Vegetation Units: The proposed development site is currently vacant land. The vegetation units on the site vary according to soil characteristics, topography and land-use. Vegetation units were identified and can be divided into 2 distinct vegetation units according to soil types and topography.

The following vegetation units were identified during the survey.

- *Acacia mellifera* shrubveld;
- Endorheic depressions (Salt pans).

Fauna Assessment: A survey was conducted during October 2013 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the quarter degree square.

Noise: The noise impact of Sishen Mine in most of the areas to the north, east and south of the mine is still relatively low. The survey found that the noise levels at the different measuring points were in line with the recommended day time noise level of 55.0dBA. The prevailing night time noise levels are below the recommended noise level for a residential area of 45.0dBA.

Air Quality: Dust fallout results are compared with the limits prescribed in GN 827 (7 December 2012). The limit value for residential and industrial areas are 600 mg/m2/day and 1200 mg/m2/day respectively measured over a 30-day period.

- It is evident that the background dust levels as measured at SB15 (a monitoring locality on a farm approximately 10km north of Sishen Mine are high (565 mg/m^2/day).
- Two of the monitoring localities have recorded annual average values of lower than 600 mg/m^2/day.
- Nine of the monitoring localities have recorded annual average values of between 600 – 1200 mg/m^2/day.

Sishen Mine has a comprehensive dust management program in place to ensure dust levels are kept as low as possible. When considering the results provided, it is important to note that the background dust fallout results, as recorded at the Wincanton monitoring station, are generally also high.

Sites of archaeological and cultural interest: A small number of Middle Stone Age (MSA) occurrences were observed at three localities in the study area. Two of these Stone Age sites occur in association with salt pans, one site specifically near Springbok Pan. The artefact scatters are mostly constituted out of debris flakes but single formals stone tools such as side scrapers, points and blades produced on fine grained specularite, jaspilite and banded iron stone, were recorded. Some of the tools display secondary retouch. Similar Stone Age scatters occur frequently in this area along the banks of the Gamagara River and around water pans and these sites has been the subject of detailed archaeological research studies. The locations of Stone Age scatters in the Sishen area correspond with a general regional Stone Age site distribution pattern where archaeological sites in the landscape occur near water sources close to local sources of rare raw materials in lithic manufacture.

Visual Environment: The surrounding vegetation in the Sishen area is mostly comprised out of mixed grasslands and scattered trees with the occurrence of semi-arid succulents in places.

Socio-Economic Environment: Sishen mine is located in the Northern Cape Province in the John Taolo Gaetsewe District Municipality (JTGDM) and the Gamagara Local Municipality. The Gamagara Local Municipality is the geographically the smallest municipal area within the District Municipality and has the second smallest population size in the area. The primary land uses include mining (iron ore and manganese) and agriculture (cattle and goat farming). Water is supplied to the municipality by the Sishen Mine as a result of dewatering of the mining pits (Ptersa, 2011).

Kathu is one of the youngest towns in South Africa, founded in 1974 and owes its existence to the Sishen Mine. Kathu is often promoted as the 'Town under the Trees' because of its location in the Kathu 'Bos' (forest), which is famous for its Camel thorn trees. The town came into being as a result of the iron ore mining activities of the then ISCOR in the area and came into being only a few decades ago. Approximately 85% of the population of Kathu and Dingleton is associated with Sishen Mine and related industries. This includes employment in the various support services and trades. The other 15% of the population functions to cater for the needs of the affiliated community that include employment in shops, banks, garages, and other retail facilities. The municipality of Kathu similarly employs a notable percentage of the population.

Process to assess alternatives

In the case of the proposed HEF Plant development, possible alternatives will be identified through discussions with authorities, discussions with I&AP's, reviewing of existing environmental data, specialist inputs/studies and discussions with the client. The alternatives will be assessed in detail in the EIA Report.

Some of the alternatives that will be assessed include:

- Technology alternatives;
- Locality alternatives,
- Status quo / no-go alternative

Specialist Studies

As a result of the above-mentioned key aspects, the following specialist studies will be undertaken during the EIA phase of the project:

- Hydrogeological study
- Traffic Study
- Air quality assessment, depending on the requirements of the Municipality following submission of the Air Emissions License amendment,
- Ecological Assessment (completed) and
- Heritage Assessment (completed).

The Way Forward

The anticipated way forward on the next phase of the EIA process is explained below.

1. **Appointment of Specialists**. The specialists have been appointed to undertake the specialist studies identified in the Scoping Report.
2. **Draft Scoping Report**. The Draft Scoping Report was placed on review for registered IAPs.
3. **Final Scoping Report**. Following the Draft review the Scoping Report has been updated with comments received, and submitted to the DENC and IAPS.
4. **Draft Environmental Impact Report.** The results of the specialist studies will be synthesized by the project team to provide a draft EIR.
5. **Draft EIR published.** The draft EIR will be made available to the DENC and the registered interested and affected parties in line with the comment periods described in the 2010 NEMA regulations. The findings will be summarised and included in the final EIR.
6. **Comments Report.** Comments on the Draft EIR will be synthesized by the project team into a comments report, which will be appended to the final EIA Report.
7. **Revise draft EIR.** The draft report will be updated by addressing and responding to the issues raised in the Comments Report. Responses from the proponent to key issues will also be included.
8. **Final EIR.** The revised final report will be compiled with the various specialist reports appended. This will be submitted to the interested and affected parties, and to the DENC for a decision with respect to the proposed development.

LIST OF ABBREVIATIONS

Abbreviation	Description
DM	District Municipality
ECA	Environmental Conservation Act (Act 73 of 1989)
EI	Environmental Impact
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
GN	Government Notice
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
JTGDM	John Taolo Gaetsewe District Municipality
KIO	Kumba Iron Ore
LM	Local Municipality
MAMSL	Meter Above Mean Sea Level
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMAQA	National Environmental Management: Air Quality Act 39 of 2004
NEMWA	National Environmental Management: Waste Act (Act 59 of 2008)
NFA	National Forest Act
NWA	National Water Act (Act 36 of 1998)
SIOC	Sishen Iron Ore Company

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1 INTRODUCTION

1.1 Project Overview

AGES Gauteng was appointed by Sishen Iron Ore Mine to facilitate the Environmental Impact Assessment (EIA) process for the proposed new High Energy Fuel (HEF) Plant on Sishen Iron Ore Mine, Northern Cape Province.

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1.2 Regional Setting

The proposed project is located to the south west of the town of Kathu, on property of the Sishen Mine, and within the existing Mining Right area, Northern Cape Province of South Africa. Refer to Figure 1-1 for the locality map.

1.3 Magisterial District and Municipality

The site falls within the jurisdiction of the Gamagara Local Municipality and the John Taolo Gaetsewe District Municipality.

1.4 Contact details of applicant

The details of the applicant are listed below:

Details of the Applicant	
Project applicant:	Sishen Iron Ore Company (Pty) Ltd (SIOC)
Contact person:	Werner Voigt
Telephone number:	053 739 2821
Fax number:	053 739 2058
Physical Address	Hendrik Van Eck Street, Kathu, 8446

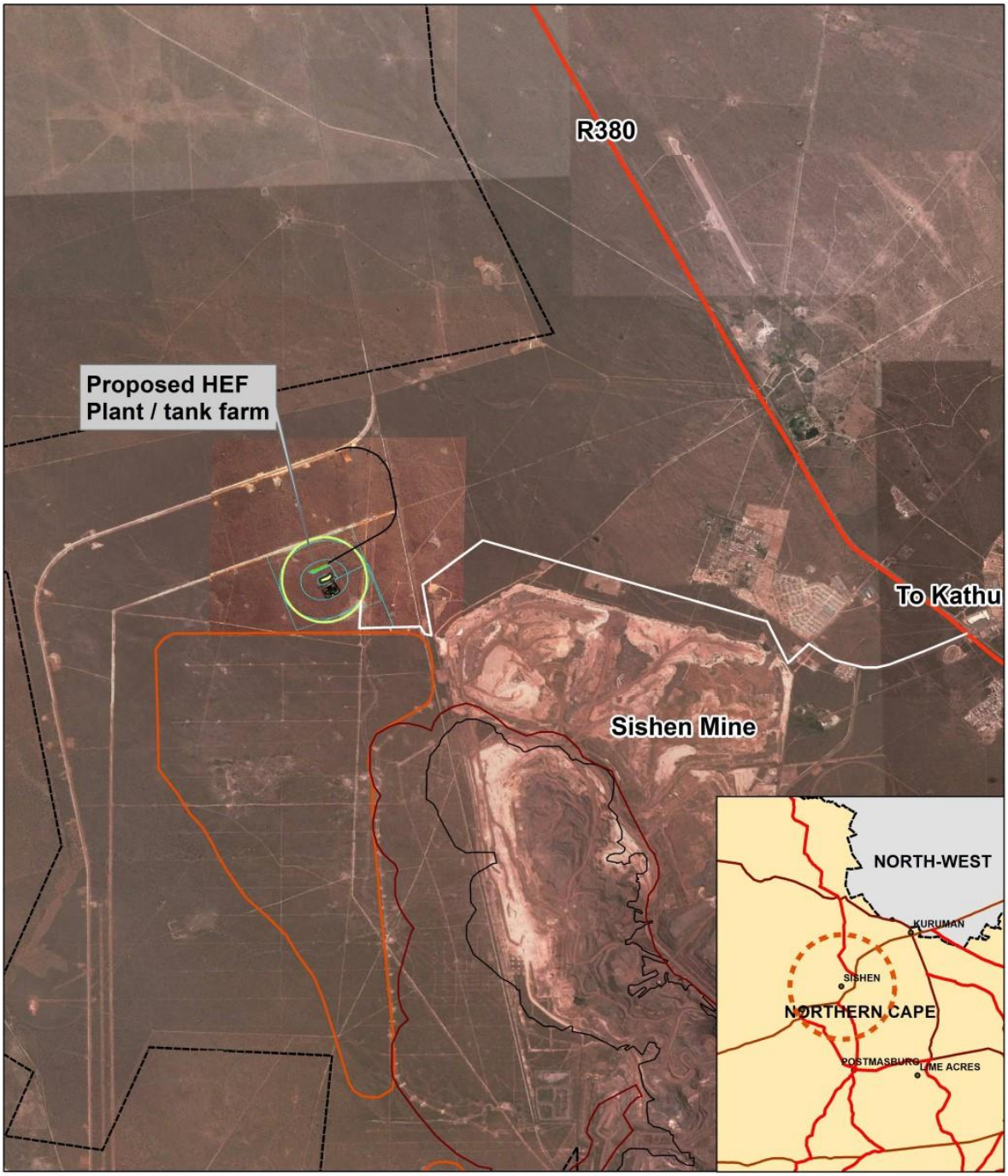
1.5 Details of the environmental assessment practitioner

As per the requirements of the National Environmental Management Act (Act No. 107 of 1998) (NEMA), as amended and the Environmental Impact Assessment Regulations of 2010, the following information is pertinent with regards to the Environmental Assessment Practitioners (EAP) that has conducted the EIA for the proposed development:

EAP	Qualifications	Years' experience
Mr Michael Grobler	BSc Hons. Conservation Ecology Pr.Sci.Nat;	9.5 years
Ms Catherine Da Camara	BSc Hons. Environmental Sciences Pri.Sci.Nat	10 years

Contact Details of Principal Environmental Assessment Practitioner:

Principal Environmental Assessment Practitioner	
Company:	AGES Gauteng
Contact person: Address	Catherine Da Camara Postnet 74, P/Bag X07, Arcadia, 0007 Pretoria
Telephone number:	012 751 2160
Fax number:	086 607 2406



Legend	Client	Project		
Access road Existing mine boundary Existing Pit Future Pit Future waste rock dumps Proposed Railway HEF plant Outer blasting zone	Sishen Mine	Sishen HEF plant / Tank Farm	N	AGES GAUTENG OFFICE 309 Glenwood Rd The Village Office Block Block E Faerie Glen Tel: +27 12 751 2160 Fax:+27 86 607 2406
	Scale 1:50 000	Locality Map		
	0 900 1 800 Meters	Compiled by C Da Camara	Version 1	
	Date 2013-12-17	Datum WGS 84	Projection	

Figure 1-1: Site Aerial Locality Map

2 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

2.1 Overview

An Environmental Impact Assessment (EIA) is an essential planning tool for any development. It identifies the environmental impacts of a proposed project and assists in ensuring that a project will be environmentally acceptable and integrated into the surrounding environment in a sustainable way. To ensure that all requirements and processes in terms of the relevant Acts (mentioned under Section 3.1) are undertaken, the following tasks need to be conducted during the EIA process (the EIA process is summarised in Figure 2-1):

- **Environmental Scoping** (current phase indicated by an arrow in Figure 2-1). Initial Investigation, communication, assessment and consideration of application and potential environmental impacts and submission of an Environmental Scoping Report and Plan of Study for Environmental Impact Assessment.

- **Environmental Impact Assessment:** After the approval of the Scoping Report and Plan of study, further investigation of environmental impacts identified during the Scoping Phase will take place. An EIA Report and Environmental Management Plan (Programme) will then be submitted with these findings.

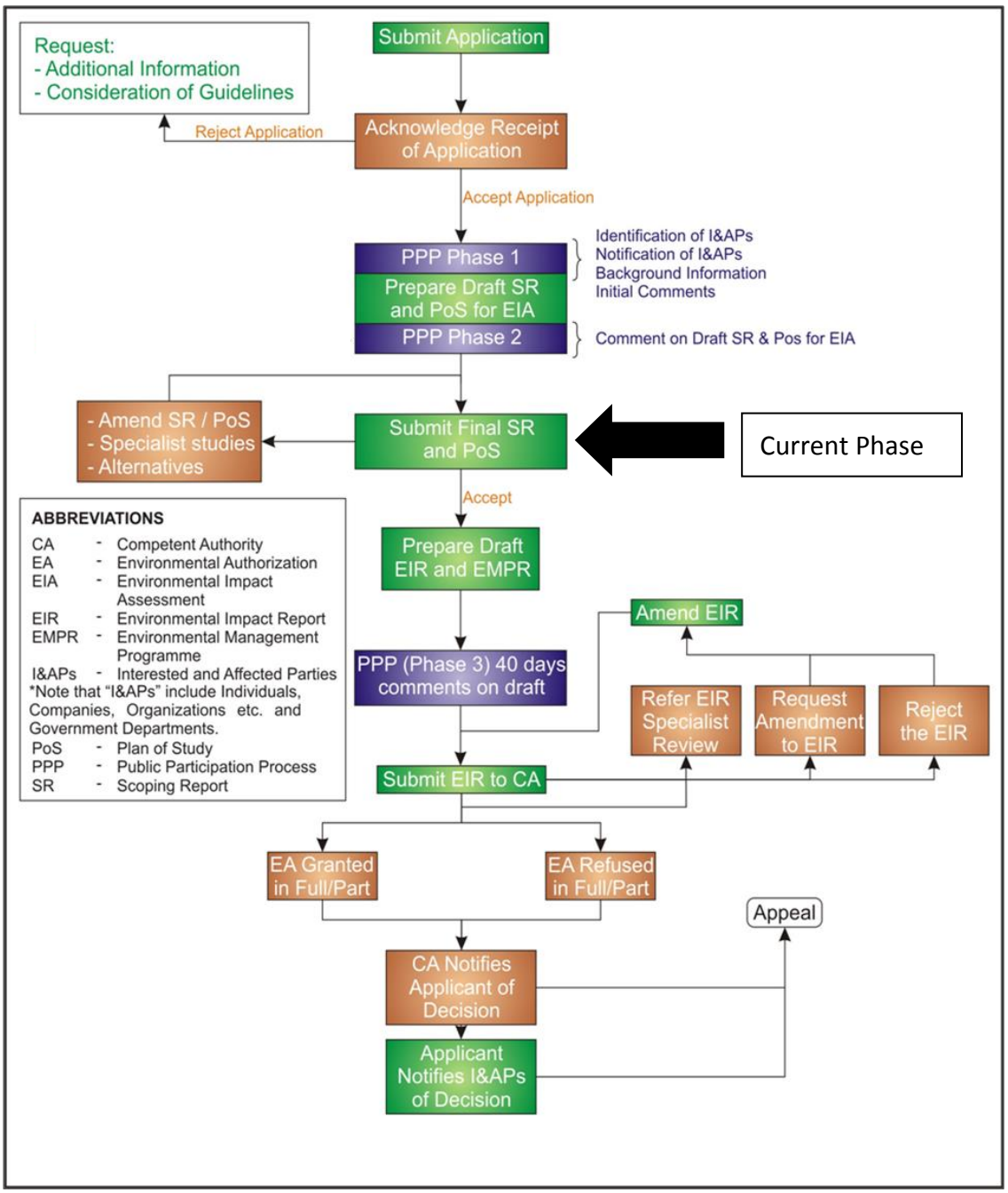


Figure 2-1: EIA process

2.2 Scoping Phase (current phase)

The project is currently in the Scoping Phase. Scoping is the process of identifying the significant issues, alternatives and decision points that should be addressed in the EIA process. The overall aim of the Scoping Phase is to identify the environmental issues and impacts associated with the proposed development that require further investigation.

More specifically, the objectives of the Scoping Phase are to:

- Identify any additional stakeholders (besides those already registered) and inform all stakeholders of the proposed activity, alternatives and the EIA process;

- Provide stakeholders with the opportunity to participate effectively in the process and identify any issues and concerns associated with the proposed activity. Significant issues will be addressed in the EIA phase of the project;
- Provide a description of the proposed activity and the need and desirability thereof;
- Provide a description of the receiving environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of this environment may be affected by the proposed activity;
- Identify statutory requirements and guidelines;
- Identify any alternatives and screen out unsuitable alternatives;
- Identify any potential impacts and environmental issues that may require further investigation; and
- Provide a plan of study for the environmental impact assessment which describes the approach to the impact assessment process.

The Scoping process comprises two parallel and integrated processes:

- A technical process to identify environmental and social impacts.
- A public participation process to provide interested and affected parties with the opportunity to raise their issues and concerns regarding the proposed project.

2.2.1 Scoping Technical Process

The technical process followed during the scoping process includes:

- Specialist Scoping which involves:
    - Assessing previous environmental and technical studies and existing information;
    - Primary screening of the project area;
    - Interaction with the project team to identify critical issues.
- Compilation of a draft Scoping Report. The draft scoping report was based on available information and issues identified during the Scoping Phase. The report introduces the proposed activities and the background to the proposed project, identification of potential issues and terms of reference for specialist studies conducted during the impact assessment phase of the EIA. The draft report was made available to the relevant authority (DENC) and other applicable government departments as well as the interested and affected parties for comment;

- Submission of a final Scoping Report. Further issues raised during the government and public review of the draft Scoping Report and on-going public participation is addressed in the final Scoping Report. This report will again be distributed to the public and to DENC.

2.2.2 Public Participation Process

The principles of the National Environmental Management Act (Act 107 of 1998) (NEMA) govern consultation with interested and affected parties (I&AP's). These principles include the provision of sufficient and transparent information to I&AP's on an on-going basis, to allow them to comment.

2.2.2.1 Identification of Interested and Affected Parties

The following process was undertaken to facilitate the public participation for the proposed project:

Newspaper Advertisement

An advertisement notifying the public of the EIA application and process and requesting I&AP's to register their comments with AGES Gauteng, was placed in the Kathu Gazette on the 23 November 2013.

Site notice

In order to inform surrounding communities and adjacent landowners of the proposed development site notices boards where placed at the following locations on the 23 November 2013:

- Kathu Library
- Sishen mine entrance (Permit office)

Direct Notification of Identified I&APs

Key stakeholders, who included the following sectors, were directly informed of the proposed project:

- The owners and occupiers of land adjacent to the site where the activity is proposed to be undertaken (alternative sites included);
- The owners and occupiers of land within 100 metres of the boundary of the site or alternative site who are or may be directly affected by the proposed activity.

The following authorities were identified and notified:

- Northern Cape Department of Environment and Nature Conservation (DENC)
- Northern Cape Department of Mineral Resources (DMR)
- Northern Cape Department of Water Affairs (DWA)
- Department of Agriculture, Forestry and Fisheries

- Department of Agriculture, Land Reform and Rural Development
- Department of Education
- Department of Home Affairs
- Department of Justice
- Development Planning, Provincial Support.

Local Authorities:

- Gamagara Local Municipality
- Kareeberg Municipality
- John Taolo Gaestsewe district Municipality
- Khara Hais Municipality
- Moshaweng Local Municipality

List of Government Agencies identified

- South African Heritage Resource Association (SAHRA)
- Eskom Distribution North Western Region
- Transnet Freight Rail
- Tshiping Water Users Association (WUA)
- Agri Kuruman
- Boegoeberg Water User Association
- McGregor Museum
- National Development Agency
- Orange Vaal Water User Association
- Sedibeng Water
- Wildlife and Environment Society of South Africa (WESSA) - Northern Cape Region

A Background Information Document (BID) with a Registration and Comment Sheet were distributed with a notification letter to all identified stakeholders on 29 November 2013. Also refer to Appendix A.

2.2.2.2 Raising of Issues for investigation by EIA Specialists

I&APs have had the opportunity to raise issues either in writing, by telephone or email. All the issues raised by I&APs during the scoping process have been captured in a Comments and Response Report (refer to Appendix A) and I&APs received letters/email acknowledging their contributions.

2.2.3 Draft Scoping Report

The EIA Regulations specify that I&APs must have an opportunity to verify that their issues have been captured. A period of 30 days was made available to allow for public comment on the draft Scoping Report. The availability of the draft Scoping Report was announced via personal notification letters, posters and/or sms to all the registered I&APs on the distribution list.

The report was made available to I&AP's as follows:

- Published on the AGES website at www.ages-docs.co.za
- Electronic copies were available to be distributed on request.

2.2.4 Final Scoping Report

A period of 30 days will be made available to allow for public comment on the Final Scoping Report. The availability of the Final Scoping Report will be announced via personal notification letters, posters and/or sms to all the registered I&APs on the distribution list.

The report will be made available to I&AP's as follows:

- Published on the AGES website at www.ages-docs.co.za
- Electronic copies will be distributed on request.

2.3 Environmental Impact Phase

2.3.1 Public Participation during the Impact Assessment Phase

Public participation during the Impact Assessment Phase of the EIA will revolve around a review of the findings of the EIA and inputs into the Environmental Management Plan (EMP). The findings will be presented in a draft Environmental Impact Assessment Report and EMP and the volume of specialist studies.

3 STATUTORY FRAMEWORK AND REQUIREMENTS

There are a number of regulatory requirements at local, provincial and national level to which the proposed development will have to conform. A brief summary of the legal requirements which are relevant to this study are outlined below. The list provided is not intended to be definitive or exhaustive and serves to highlight key environmental legislation and obligations only. Identification and interpretation of these will be considered in further detail as part of the EIA application.

3.1 Legislation applicable to the project

3.1.1 The National Environmental Management Act (107 of 1998) (NEMA) and the Environmental Impact Assessment Regulations, 2010

The overarching principle of the National Environmental Management Act 1998 (Act 107 of 1998) (NEMA) is sustainable development. It defines sustainability as meaning the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure the development serves present and future generations.

The Environmental Impact Assessment (EIA) process to be undertaken in respect of the authorization process of the proposed development will be in compliance with the NEMA, as read with the Environmental Impact Assessment Regulations of 2010 (Government Notice No's R543, R544, R545 and R546 of 2010). The proposed development involves 'listed activities', as identified in terms of the NEMA and in terms of section 24(1), the potential consequences for or impacts on the environment of these listed activities must be considered, investigated, assessed and reported to the competent authority, except in respect of those activities that may commence without having to obtain an environmental authorisation in terms of the NEMA.

Table 1: Identification of Listed activities triggered under the NEMA 2010 Regulations

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity:
GNR 544 of 2010	22	The construction of a road, outside urban areas, (i) with a reserve wider than 13,5 meters or, (ii) where no reserve exists where the road is wider than 8 metres, or (iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.
	37	The expansion of facilities or infrastructure for the bulk transportation of water, sewage or storm water where: (a) the facility or infrastructure is expanded by more than 1000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more– excluding where such expansion: (i)relates to transportation of water, sewage or storm water within a road reserve; or (ii)where such expansion will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse
	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres – excluding widening or lengthening occurring inside urban areas.
	53	The expansion of railway lines, stations or shunting yards where there will be an increased development footprint – excluding: (iii) railway lines, shunting yards and railway stations in industrial complexes or zones; (iv) underground railway lines in mines; and (v) additional railway lines within the reserve of an existing railway line.
GNR 545 of 2010	3	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.

	5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.
	26	Commencing of an activity, which requires an atmospheric emission licence in terms of section 21 of the National Environmental Management Air Quality Act (Act no 39 of 2004), except where such commencement requires basic assessment in terms of Notice No. R 544 of 2010.
	11	The construction of railway lines, stations or shunting yards, excluding - (i) railway lines, shunting yards and railway stations in industrial complexes or zones; (ii) underground railway lines in a mining area; and (iii) additional railway lines within the reserve of an existing railway line;
GNR 546 of 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: (1) purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes; (2) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list; (3) the undertaking of a linear activity falling below the thresholds in Notice GNR544 of 2010.

3.1.2 Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA)

The MPRDA governs mining in South Africa, affirms the State's obligation to protect the environment for the benefit of present and future generations, to ensure ecologically sustainable development of mineral and petroleum resources and to promote economic and social development.

The Sishen HEF Plant Project will have to apply for an amendment to the existing EMPR in terms of the MPRDA from the Department of Mineral Resources (DMR), and manage the mine operations in accordance with an amended Environmental Management Programme (EMPR).

The MPRDA states that the holder of a mining right:

- Must at all times give effect to the general objectives of integrated environmental management laid down in Chapter 5 of NEMA;
- Must consider, investigate, assess and communicate the impact of his or her

prospecting or mining on the environment as contemplated in section 24(7) of NEMA;

- Must manage all environmental impacts –
    - In accordance with an environmental management plan or approved environmental management programme, where appropriate, and
    - As an integral part of the mining operations, unless the Minister directs otherwise.
- Must as far as reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and
- Is responsible for any environmental damage, pollution or ecological degradation as a result of prospecting or mining operations and which may occur inside and outside the boundaries of the area to which such right, permit or permission relates.

3.1.3 The National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA)

The National Environmental Management Air Quality Act (Act 39 of 2004) (NEMAQA) came into power on the 1st of April 2010. Subsequently, General Notice 893 (GN 893) came into effect on 22 November 2013. This Notice provides a list of activities that may cause atmospheric emissions which have or may have a significant detrimental effect on the environment as well as the minimum emission standards ("MES") for these activities as contemplated in section 21 of NEMAQA.

The effect of the commencement of the NEMAQA and the listed activities, listed in GN 893 is that an atmospheric emission licence (AEL) is now required for conducting these listed activities. In view of the above, the following listed activity may be relevant in terms of GN 893:

GN 248 Category 2: Petroleum industry, the production of gaseous and liquid fuels as well as petrochemicals from crude oil, coal, gas or biomass.

Subcategory 2.4: All permanent immobile liquid storage facilities at a single site with a combined storage capacity of greater than 1000 cubic meters.

Sishen Mine has an Air Emissions Licence (AEL). It will be established whether the AEL will require amendment due to the additional diesel storage facilities.

3.1.4 National Water Act (Act No 36 of 1998) (NWA)

In terms of Section 22 of the National Water Act (NWA) a person may only use water without a license under certain circumstances. All other use, provided that such use qualify as a use listed in section 21 of the Act, require a water use license. A person may only use water without a license if such water use

is permissible under Schedule 1 (generally domestic type use), if that water use constitutes a continuation of an existing lawful water use (water uses being undertaken prior to the commencement of the NWA, generally in terms of the Water Act of 1956), or if that water use is permissible in terms of a general authorisation issued under section 39 (general authorisations allow for the use of certain section 21 uses provided that the criteria and thresholds described in the general authorisation is met).

The project will require water use licensing in terms of Section 21 c, i and g of the NWA.

Table 2: Water uses to be licensed

Water use no	Description	Water use activity
21 c) and (i)	*Impeding or diverting the flow of water in a watercourse* *Altering the bed, banks, course or characteristics of a watercourse*	Location of the HEF plant within 500 m of a wetland (pan)
21 (g)	*Disposing of waste in a matter which may detrimentally impact on a water resource*	Disposal of waste (wash bay) with a capacity of 1000 m^3, and a Honey-Sucker Tank with a capacity of 40 m^3

3.1.5 The National Heritage Resources Act (Act 25 of 1999) (NHRA)

The NHRA established the South African Heritage Resources Agency (SAHRA) as well as provincial heritage resources agencies. In terms of the NHRA, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

No person may, without a permit issued by SAHRA or a provincial heritage resources authority destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves; destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or bring onto or use at the burial ground or grave referred to above any excavation equipment or any equipment which assists in the detection or recovery of metals.

The proposed development site was visited by a qualified archaeologist to verify the existence of any sensitive sites or materials in terms of the NHRA and the findings are presented in Section 0.

3.1.6 Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA)

Table 4 of the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) lists indigenous plant species that should be regarded as indicator plants for bush encroachment. *Acacia mellifera*, the tree species identified for the making of firewood and charcoal, is such a declared indicator of bush encroachment within the Northern Cape, Limpopo and North-West Provinces.

Regulation 16(2) of the CARA has the following implications for a landowner that has an indigenous invading plant on his property:

"A land user of an area in which natural vegetation occurs and that contains communities of indicator plants shall follow practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs."

The landowner therefore has a responsibility to combat bush encroachment on his property. The CARA furthermore states in Regulation 16(3) that practices should be followed to remove the cause of the deterioration of natural resources and to improve and maintain the production potential of the natural pastoral land. According the Regulation 16(3) the following practices, amongst others, can be followed to get rid of invading plants:

(a) Uprooting, felling or cutting;

(b) Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer;

(c) The application of control measures regarding the utilisation and protection of veld in terms of regulation 9;

(d) The application of control measures regarding livestock reduction or removal of animals in terms of regulations 10 and 11;

(e) Any other method or strategy that may be applicable and that is specified by the executive officer by means of a directive."

The landowner is therefore obliged to act against bush encroachment should a species declared to be an indigenous invader, such as *Acacia mellifera*, be present on his/her property.

3.1.7 Protected Tree Removal – Section 15 of NFA

The project may involve the cutting, disturbing, damaging or destroying of protected trees declared in terms of section 12 of the NFA. The protected species: *Boscia albitrunca* (Shepherd Tree) occurs on the site. If protected trees are to be removed, a licence in terms of section 15 of the NFA may be required as part of the EIA.

4 DESCRIPTION OF THE PROJECT

4.1 Purpose

The purpose of the High Energy Fuel Plant is to manufacture and store emulsion explosives that will be used for blasting within the mine pit.

4.2 Motivation

The current explosives facility, consisting of a HEF plant, Explosives magazines, PPAN store and all related infrastructure is situated near the slimes dams at Sishen Mine. This area is now required for the expansion of the slimes dams, and the construction of infrastructure for the mine. It is therefore proposed that a new HEF plant be constructed as the current location of the HEF plant does not allow for expansion.

4.3 Description

Emulsion explosives consist of distinct fuel/oil and oxidiser phases. They are popular because of the ability to transport and handle two non explosive phases until they are blended and pumped into the blast hole at the mine.

Even when finally combined they only have a relatively low sensitivity and require a booster and confinement to ensure effective detonation. Two of the most notable physical chemical properties of emulsions are its water resistance and high bulk density. These properties also have advantages in minimizing environmental risks associated with manufacture and transportation. Even when finally combined.

Most of the High Energy Fuel (HEF) components are received from BME Group including Ammonium Nitrate Calcium Nitrate (AN/CN) solution.

The AN/CN solution will be transported in bulk carriers to the mine and stored in silos at the HEF plant. The Ammonium Nitrate Porous Prills2 (ANPP) used are manufactured by AEL Mining Services and transported to the mine in bulk carriers and via bottom dumper railway trucks and will be kept in a store with 3600 tons capacity.

Fluiden and used recycled oil will be used in the manufacturing of the HEF and will be transported to the mine in bulk carriers and stored in tanks within bunded areas.

The product is made by blending in a number of mixers and stored in various silos or tanks. Emulsion explosives consist of a blended fuel/oil phase and then a separately produced oxidizing phase (which is produced by the mixing of the “Gassing” materials including ammonium nitrite). These products are loaded separately into the different compartments of MMU’s (Mobile Manufacturing Units).

2 A **prill** is a small aggregate of a material, most often a dry sphere, formed from a melted liquid. **Prilled** is a term used in mining and manufacturing to refer to product that has been pelletized. The pellets are a neater, simpler form for handling, with reduced dust.

The HEF manufacturing facility will consist of (Figure 4-1 and

Figure 4-2):

- A HEF Plant:
    - A bulk storage facility for ANCN (Ammonium Nitrate Calcium Nitrate) ;
    - A bulk storage facility for recycled oil and fuel;
    - A store (drums and bags) for product storage (Thiouria, Sulphamic acid, Sodium nitrate, E23);
    - A store for spares and tyre storage;
    - A bulk storage facility for manufactured HEF;
    - A laboratory for quality control;
    - A weighbridge;
- Bulk ANPP storage facility;
- Explosives magazine facility;
- Administration building supporting the facilities;
- Ablution and change house facility;
- Wash bay facility;
- Calibration facility for explosives trucks;
- All infrastructure required in supporting the abovementioned facilities;
- Access road;
- A rail line for offloading ANPP; and
- Establishment of boreholes to monitor ground water quality.

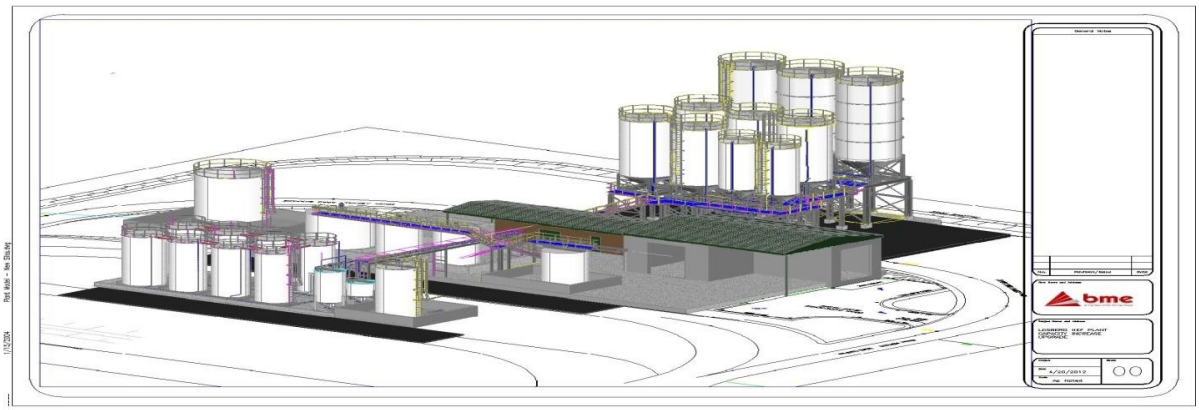
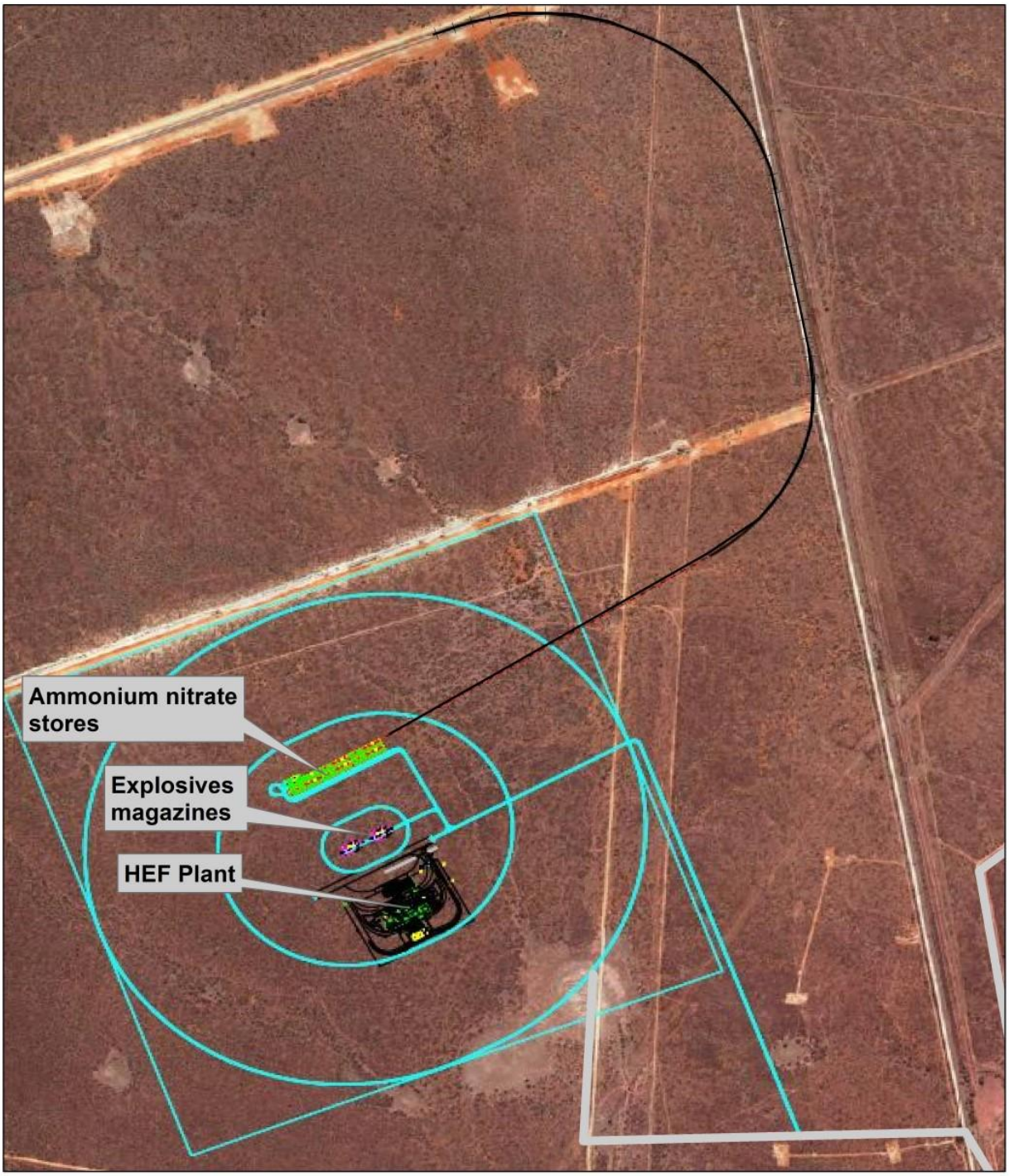
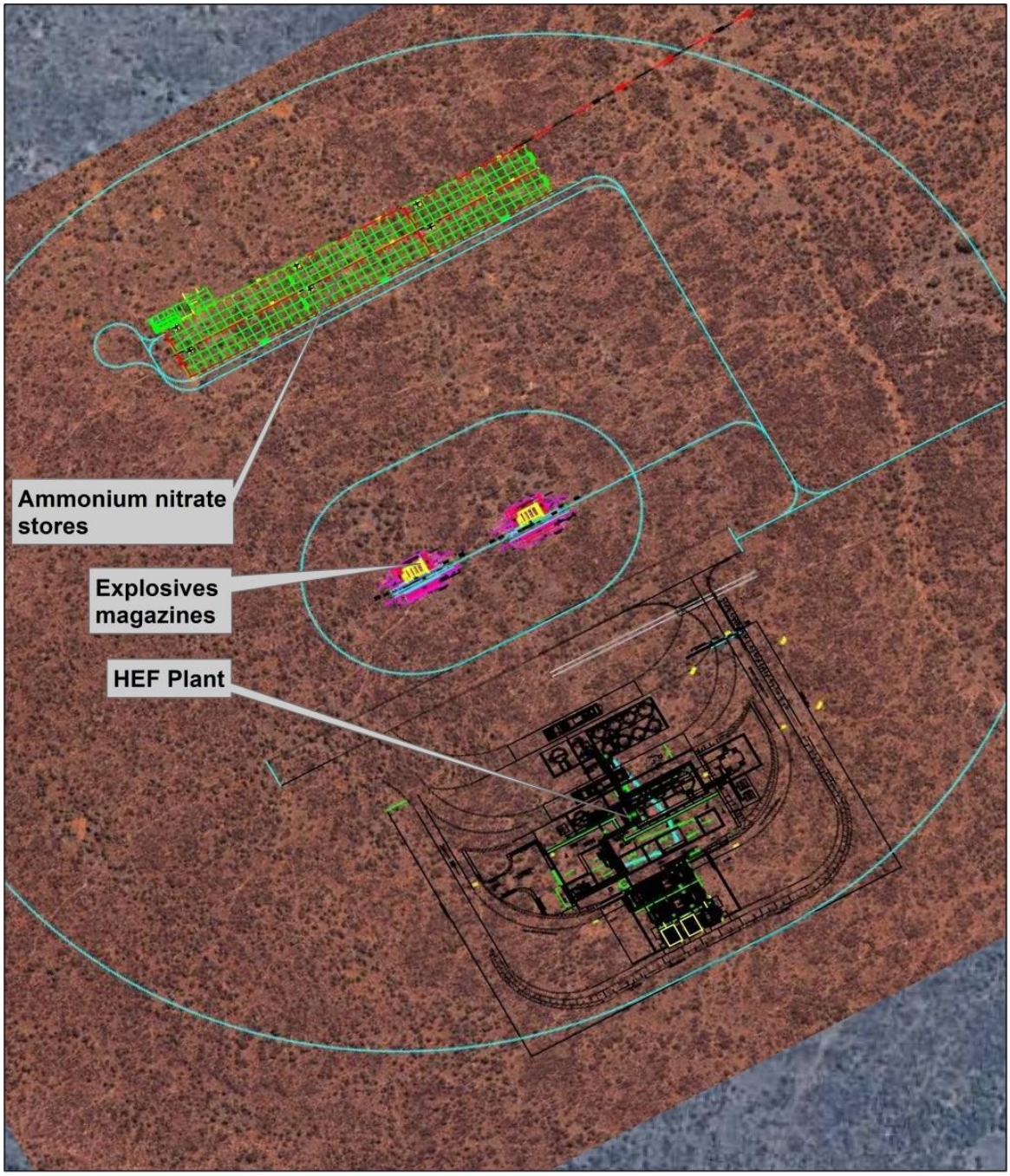


Figure 4-1: Illustration of proposed HEF manufacturing facility



Legend Access road Proposed Railway	**Client** Sishen Mine	**Project** Sishen HEF plant	N	AGES GAUTENG OFFICE 309 Glenwood Rd The Village Office Block Block E Faerie Glen Tel: +27 12 751 2160 Fax:+27 86 607 2406
	Scale 1:8 000	**Site layout indicating railway tie-in**		
	0 145 290 Meters	**Compiled by** C Da Camara	Version 1	
	Date 2013-12-17	**Datum** WGS 84	Projection	

Figure 4-2: Layout Plan



Legend	**Client** Sishen Mine	**Project** Sishen HEF plant	N	AGES GAUTENG OFFICE 309 Glenwood Rd The Village Office Block Block E Faerie Glen Tel: +27 12 751 2160 Fax:+27 86 607 2406
	Scale 1:2 000	**Site layout**		
	0 35 70 Meters	**Compiled by** C Da Camara	Version 1	
	Date 2013-12-17	**Datum** WGS 84	Projection	

Figure 4-3: Layout plan (zoomed)

4.3.1 Stormwater Management System

The GN 704 of 1999 regulations regarding the use of water for mining and related activities aimed at the protection of water resources, require that water resources be protected from pollution, and as such, contaminated and non-contaminated water must be separated.

A stormwater management system is planned which will separate cleanwater and dirty water area. The stormwater management system has been designed to adhere to the GN 704 requirements. Water collecting at the facility will not be allowed to flow off-site.

The following will be in place:

- Oil and silt traps at the delivery receipt bays;
- Oil separation system;
- Clean water channels;
- Impounding basin, concrete lined;
- Water treatment plant; and
- The facility boundaries will be bermed to stop any overland water from entering the site.

The water will flow through silt traps and be channelled to a sump. The water will then pass through an oil separation system and through a water treatment plant. The water will be recycled as process water at the HEF Plant.

4.3.2 Access Roads

An access road will be required. The road will be extended from the new Diesel tank/Aldag refuelling site (refer to Figure 1-1).

The access road will consist of two (2) 3.7m wide surfaced lanes with a 1.5m wide gravel shoulder either side (as per Municipal specifications) and will be approximately 2km in length. The road will be gravel surface and culverts will be installed to deal with storm water.

5 ENVIRONMENTAL BASELINE DESCRIPTION

Regulation 28(1)(a) of the NEMA Regulations (GNR 543) requires a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity, in order to determine remedial measures and associated environmental management objectives.

The information contained in the following section describes the baseline environmental conditions at the Proposed HEF Plant and surrounds in terms of the Biophysical Environment and the Socio-Economic Environment. The aim is to establish how the existing environmental conditions may be affected by the proposed project, and how the proposed project may be affected by the existing receiving environment.

The description of the baseline environment of the proposed development sites contained in this section was based on desktop-studies and available information as well as a number of specialist studies conducted for the project, as referenced in the applicable sections and contained in Appendix C at the end of this report. The following specialist studies were undertaken:

- Heritage Assessment
- Ecological Assessment
- Hydrogeological Baseline Assessment (currently being undertaken).

5.1 Geology

The Sishen iron ore deposits are the Superior-type banded iron formations (BIFs) of the Transvaal Supergroup lithologies. The Transvaal Supergroup rocks were deposited in two related sedimentary basins, one in an extensive continental shelf environment and the other in an intra-continental sea, both situated on the present Kaapvaal Craton. The Griqualand West basin occurs on the western margin of the Kaapvaal Craton and hosts the largest high-grade hematite ore on the Southern African continent. The iron ore deposits occur in the Transvaal and Olifantshoek Supergroups and form a regional anticlinal structure termed the Maremane Dome. Due to the Maremane Dome, the geological succession dips to the west so that mining becomes deeper. The Sishen Iron Ore Mine is located at the northern end of the Maremane anticline, with the Beeshoek Mine and Kolomela Mine at the southern end (Figure 5-1).

The HEF plant project site is underlain by Kalahari sand, calcrete, clay, conglomerate, Dwyka Tillite and lava. The deeper located geologies is banded iron formation (BIF) and fine and coarse grained dolomite, chert and dolomitic limestone with prominent interbedded chert, limestone and banded ironstone with chert breccia capping the Ghaap Plateau Formation.

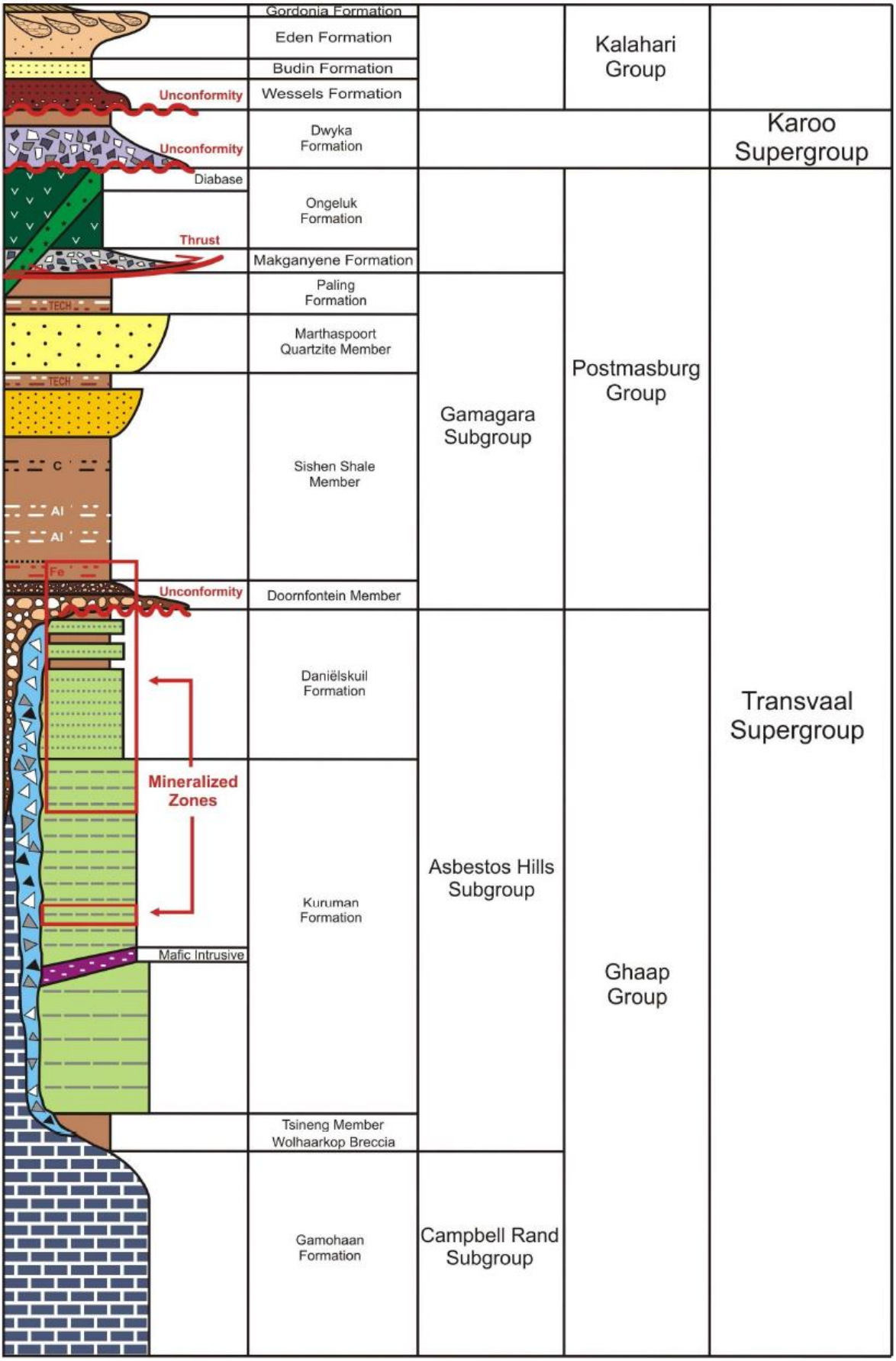


Figure 5-1: Typical Stratigraphical Column (Mining Work Programme, 2010)

5.2 Climate

5.2.1 Regional Climate

In terms of the climatic region, the proposed project site falls within the Kalahari Bushveld Region (South African Weather Service, Climatic Regions). Climatic conditions consist of warm summers with moderate but very dry winters (SIOM EMPR; 2002).

5.2.2 Rainfall

The climate is described as semi-arid with a Mean Annual Precipitation (MAP) of approximately 369 mm/a as measured at from 1963 to 2011. The North Mine has a higher MAP of 381 mm/a and Kathu the highest MAP at 461 mm/a. The study area falls within a summer rainfall region, with over 89% of the annual rainfall occurring from November to April. The majority of rain falls in the late summer months of January, February and March.

Extreme rainfall related weather conditions, i.e. thunder, hail and fog, are dominated by thunder activities peaking between October and March, while frequent frost occurs in the winter months from May to August. The winters are extremely dry with the lowest rainfall being recorded for the months of June, July and August. (SIOM EMPR, 2002).

Rainfall data is presented in Figure 5-2 below.

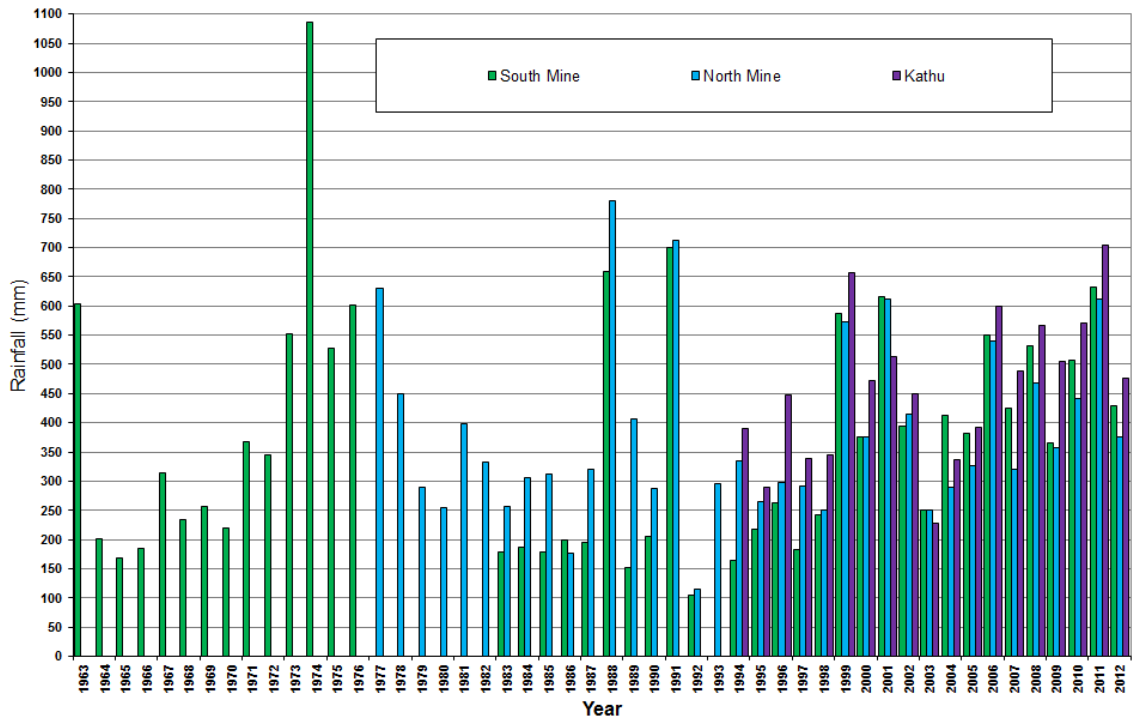


Figure 5-2: Annual Rainfall for Sishen Mine and Kathu (SIOM, 2012)

5.2.3 Temperature

The mean annual temperature at the Sishen Mine is 19ºC. The average annual maximum temperature is 26,7ºC and minimum temperature is 11,8ºC. January is the warmest month with an average maximum temperature of 32,9ºC and July is the coldest month with an average minimum temperature of 3,1ºC. The mean monthly temperatures at Sishen Mine are illustrated below (Figure 5-3).

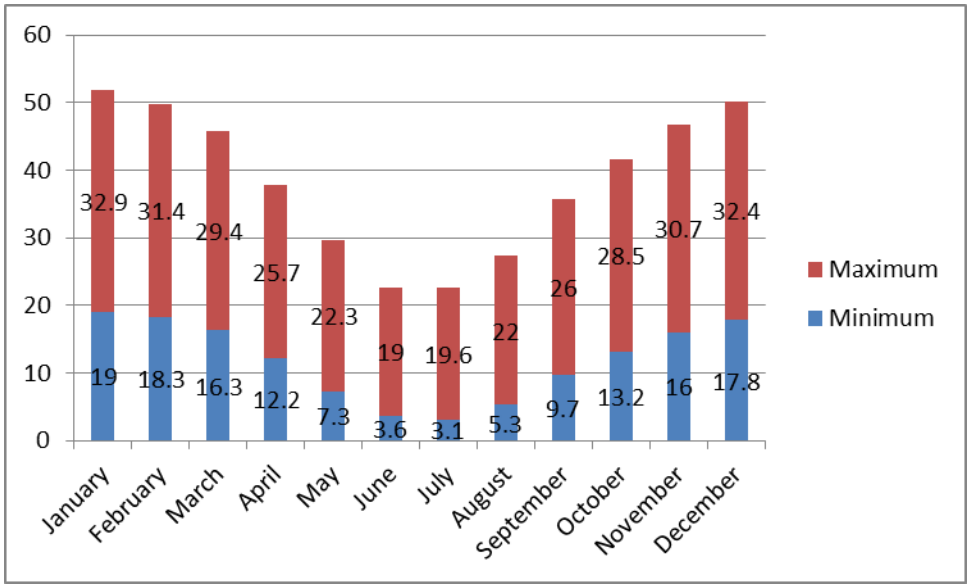


Figure 5-3: Average Minimum and Maximum Temperatures (Sishen Weather Station (Station No. 0356857AX)

5.2.4 Evaporation

The average evaporation rate is very high at 2276 mm/a, which is almost six times the MAP (Vivier & Kruidenier, 2012).

5.2.5 Wind Direction and Speed

At Sishen mine the prevailing wind direction is from the northwest (strongest winds) during the daytime and the southeast. Daytime airflow is characterised by higher occurrence of strong winds of more than 5 m/s. There is an increase in the number of calm conditions during the night; from 7.2% (daytime) to 12.6% during the night. The wind velocity also decreases significantly and the airflow changes to be predominantly from the southeast during the night (Airshed, 2012). Period, daytime and night-time wind roses for Sishen Mine for the abovementioned period are provided in Figure 5-4.

5.2.6 Extreme Weather Conditions and Hazards

Fog and snow are unlikely to occur at Sishen. Thundershowers occur irregularly in the summer months, from October to March. Frost occurs in the winter months, from May to August. Excessively high temperatures, above 45ºC, typically occur in the months of December and January and are often correlated with an excessively low humidity volume.

The highest recorded precipitation in 60 minutes and 24 hours, and the expected maximum precipitation event over 24 hours for the return periods of 25, 50 and 100 years are provided in Table 3 below.

Table 3: Recorded Storm Events and Predicted Flood Events

	Maximum recorded in:		Expected maximum in 24 hours for period:		
Recurrence Interval	60 min	24 hrs	25 yrs	50 yrs	100 yrs
Maximum Rainfall intensity (mm)	35.9	101.0	92.1	108.5	124.7
Source: Sishen Weather Station (Station No. 0356857AX) 1961 to 2001.					

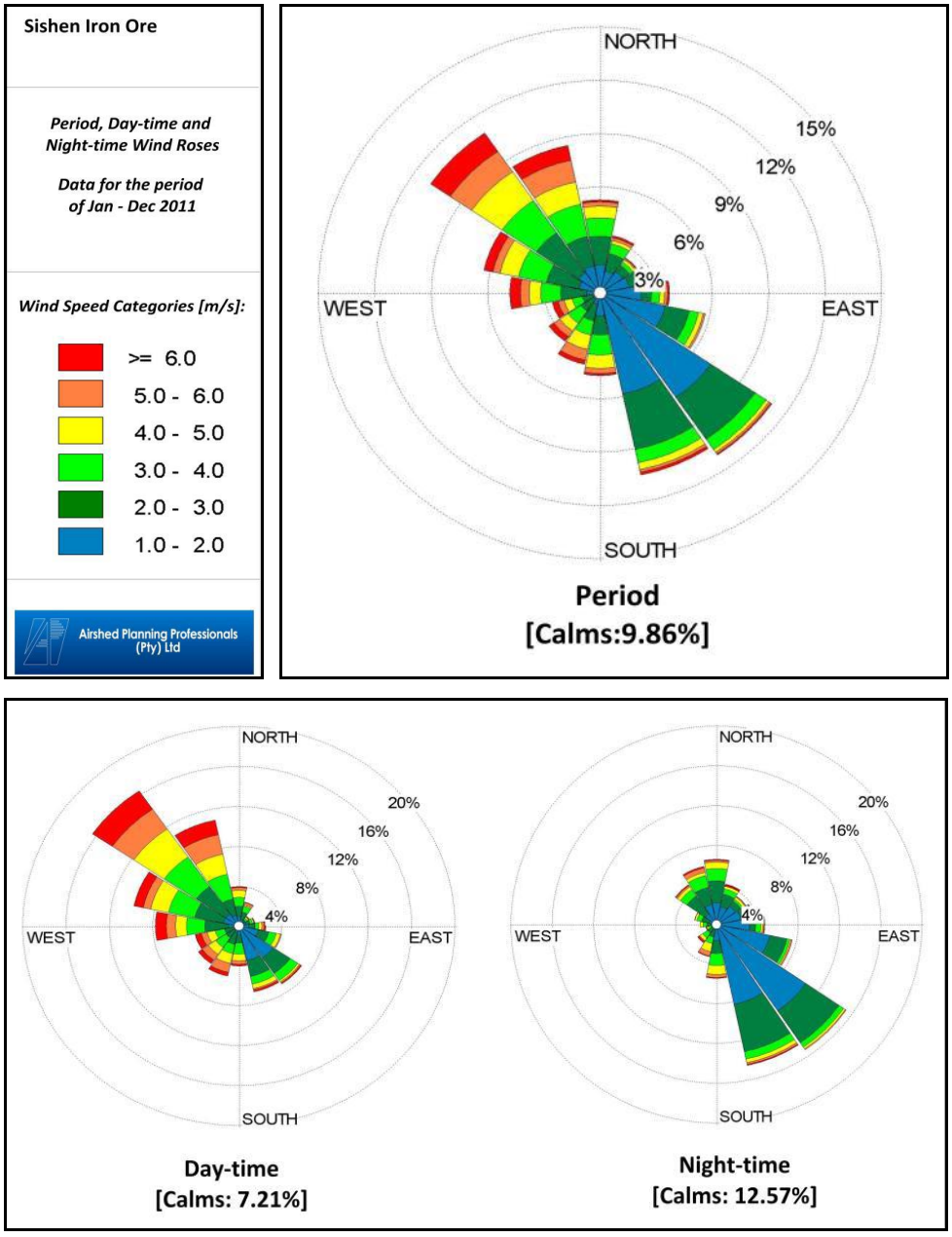


Figure 5-4: Wind roses for Sishen Iron Ore Mine (Airshed 2013).

5.3 Topography and Drainage

The natural topography surrounding the Sishen Mine is generally flat with some isolated undulating areas. The average altitude of the flat plains is at 1200 metres above mean sea level. There are a number of hills, stretching up to 1350 metres above mean sea level, to the southeast of the Sishen mining areas, close to the N14 road. The Langberg is located approximately 35 km southwest of Sishen Mine. The general slope of the land, specifically the Sishen mining area, is in a westerly and south-westerly direction towards the ephemeral Gamagara River. According to the Environmental Potential Atlas of South Africa (ENPAT, 2000) the project area is classified as being “Level Plains with some relief” (Figure 5-5).

The natural topography of the site has been significantly altered as a result of historic and on-going mining activities. Currently, the existing mine infrastructure and activities dominate the landscape at Sishen, and the natural, relatively flat topography has been replaced by man-made topographical features.

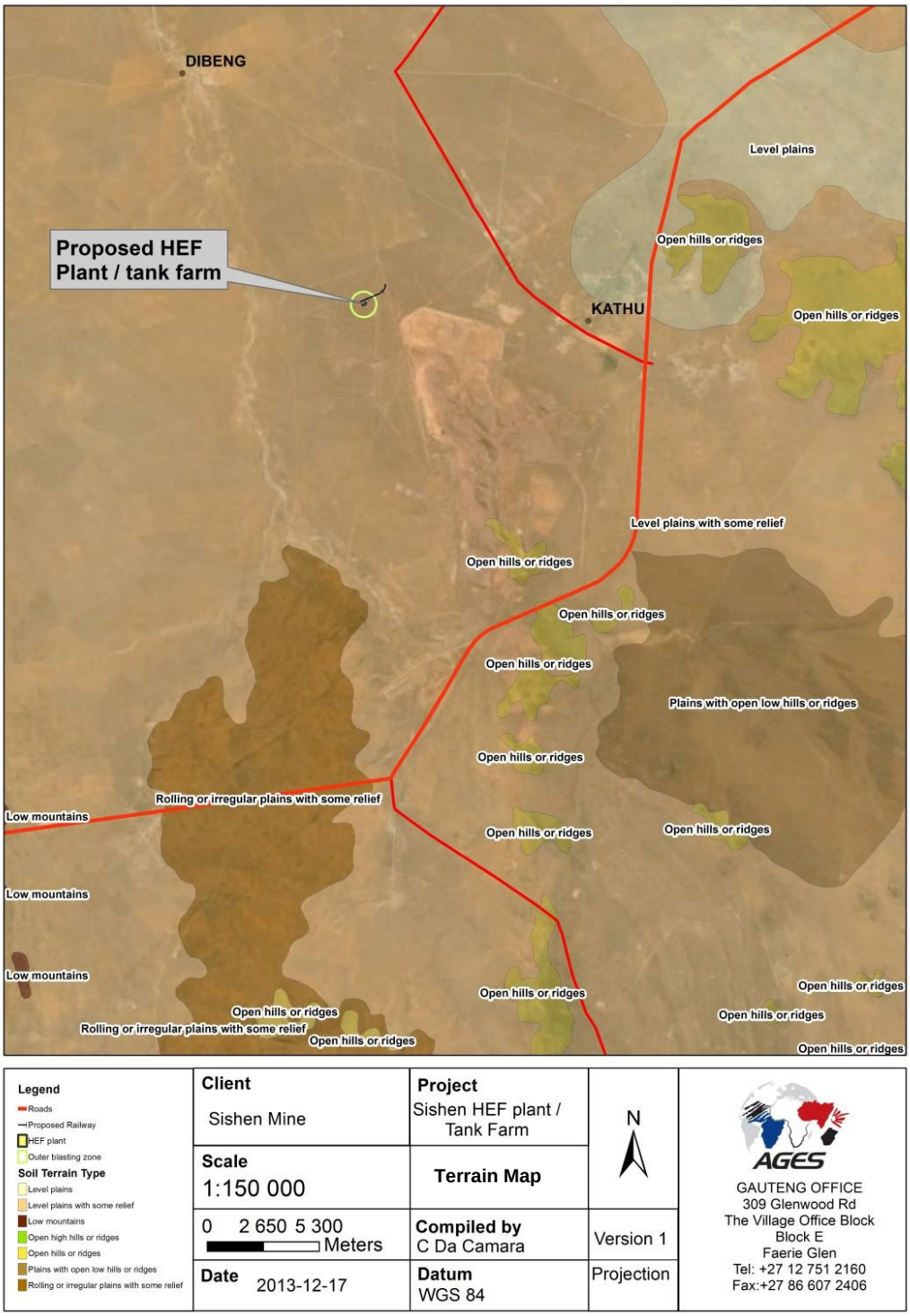


Figure 5-5: Terrain Map

5.4 Surface Water

The project area is situated within the quaternary catchment D41J, which is located in the Lower Vaal Water Management Area (WMA). There are no perennial rivers in the area. The local quaternary catchment D41J covers an area of 3 847 km^2 (Figure 5-6). The catchment system is endoreic with the Gamagara River flowing into the Kuruman River close to Hotazel. The Kuruman River flows into the Molopo River at Andriesvale south of the Kalahari Gemsbok Park. From there, the Molopo flows into the Abiekswasputs pans north of the town of

Noenieput. There is no outflow to the sea.

The Gamagara River is located 6.5 km to the west of the site. The Gamagara is a non-perennial river which flows north-northwest.

The only natural wetland areas in the project area described as Southern Kalahari Salt Pans (Mucina & Rutherford, 2006). These pans are also known as playas. DWAF (2003) states that in order to classify an area as a wetland it must have one or more of the following attributes:

- Hydromorphic soils that exhibit features characteristic of prolonged saturation;
- The presence of hydrophytes (even if only infrequently);
- A shallow water table that results in saturation at or near the surface, leading to the development of anaerobic conditions in the top 50cm of the soil.

This wetland type on site can be classified as a depression known as an endorheic pan. A depression is a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. Dominant hydrodynamics are (primarily seasonal) vertical fluctuations. Pans such as in the study area are flat-bottomed lack in and outlets. For this 'endorheic depression', water exits by means of evaporation and infiltration (Ecological Assessment - Appendix C1).

Locally, the proposed HEF plant project area drains towards the north-northwest. As a result of the relatively low rainfall there is a low amount of runoff expected and therefore a low amount of sediment yield from natural runoff (AGES, 2013).

Sishen Mine manages storm water runoff through an over-all storm water management master plan compiled for the mine in accordance with the relevant legislation. The HEF Plant project will have its own stormwater management plant to also comply with GN704 (Please refer to section 4.3.1 for more detail on the stormwater management on site).

5.4.1 Water Quality

The overall John Taolo Gaetsewe District Municipal area has good water quality due to the large area being underlain by dolomite, an aquifer with good storage and recharge capacity.

Most of the domestic water used in the John Taolo Gaetsewe District Municipal Area is supplied to the area via the Vaal-Gamagara Government Water Supply Scheme, also known as the Kalahari East Pipeline. Along the way, excess ground water of acceptable quality, originating from dewatering activities at some of the Northern Cape mines along the pipeline route, is added to the network. This addition of suitable groundwater to the pipeline system assists in supplying users with potable water.

Further details with regards to the water quality will be investigated during the EIA phase through the Geohydrological Impact Assessment.

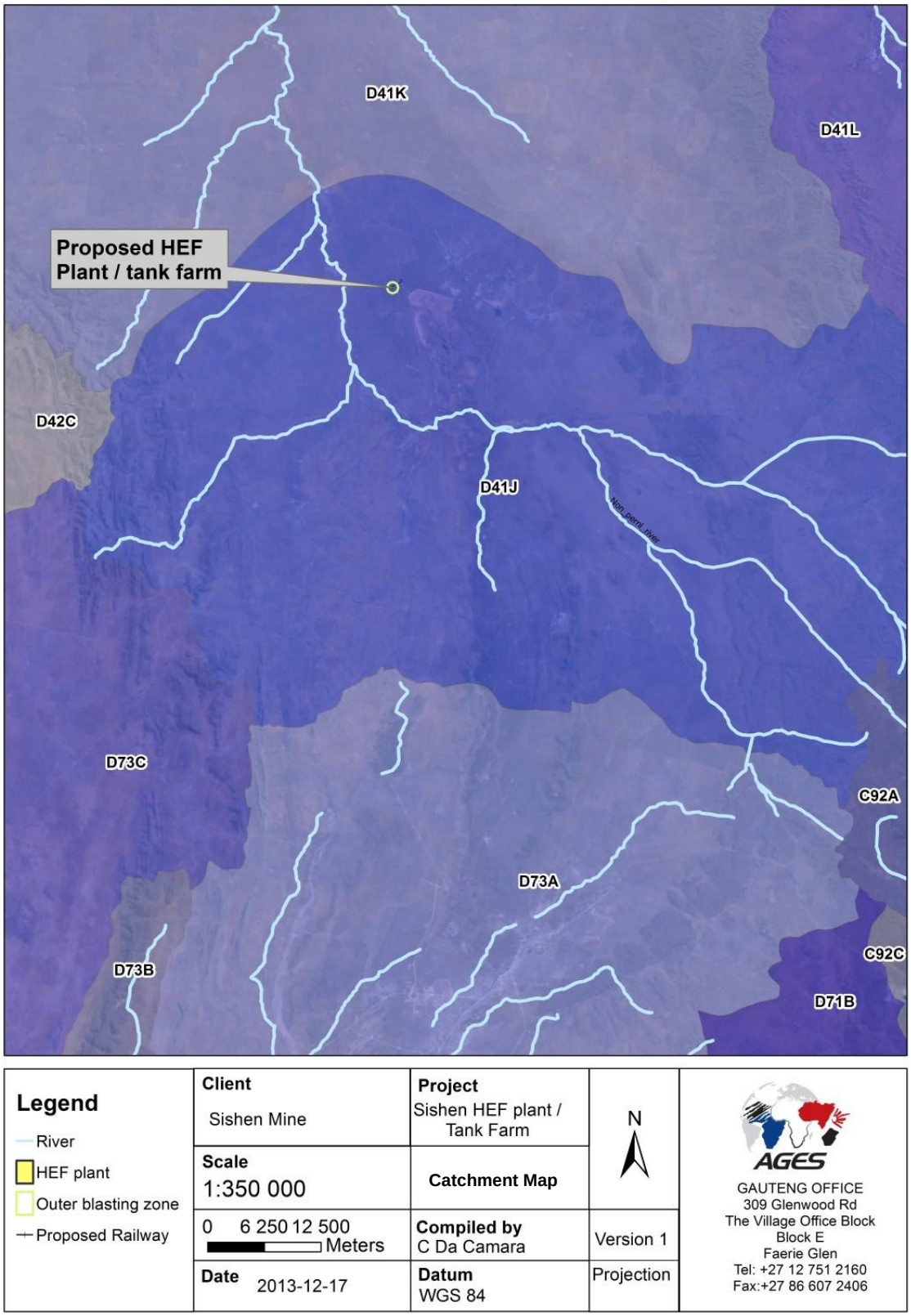


Figure 5-6: Catchment locality map

5.5 Soil Types

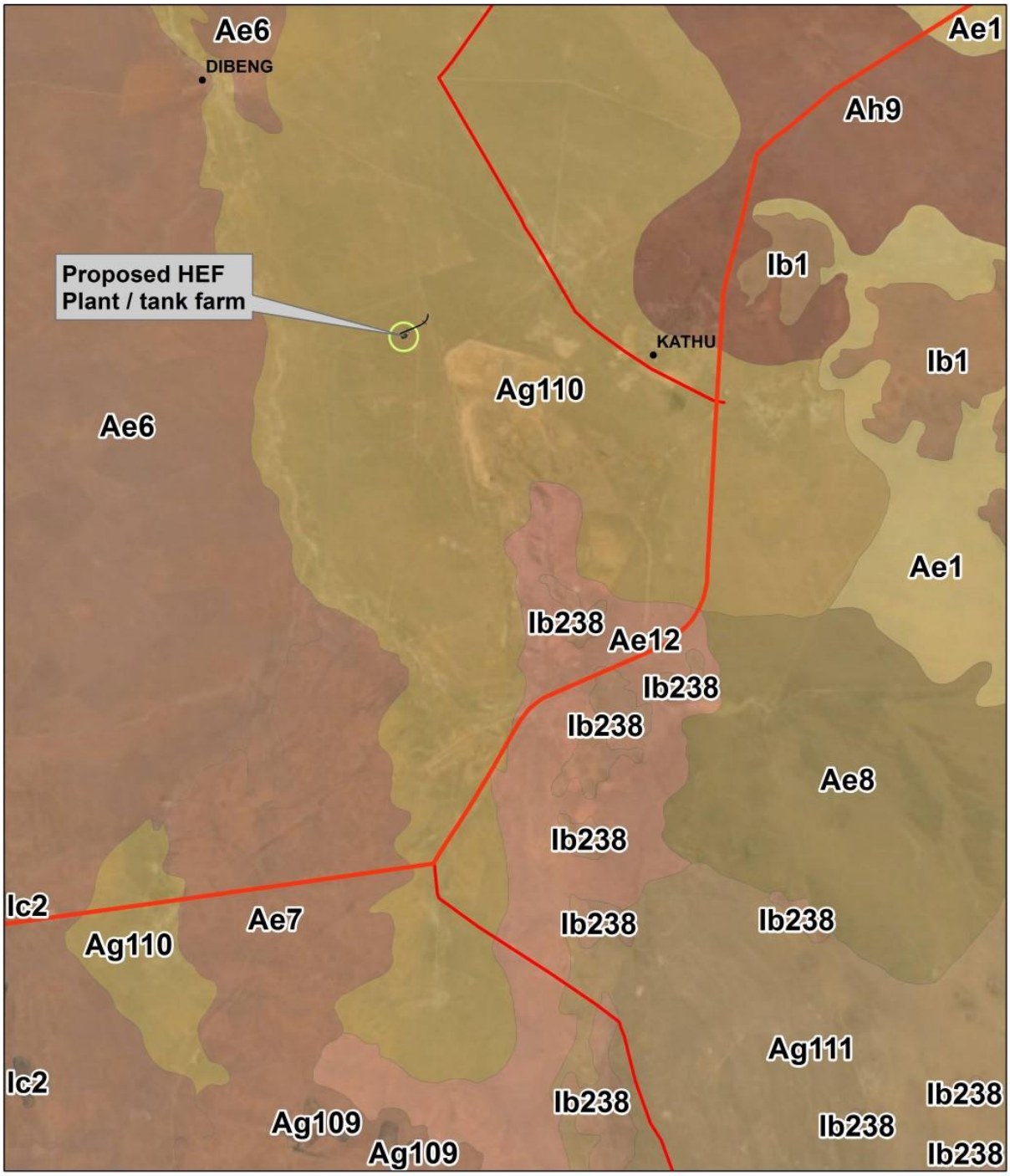
A Land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The land type unit represented within the proposed footprint area include the Ag110 land type (Land Type Survey Staff, 1987) (ENPAT, 2000) indicated in Figure 5-7. The land type, geology and associated soil type is presented in Table 4 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000).

Table 4: Land types, geology and dominant soil types of the proposed development site

Land type	Soils	Geology
Ag110	Red-yellow apedal, freely drained soils, red, high base status, < 300 mm deep	Surface limestone, alluvium and red wind-blown sand of Tertiary to Recent age with a few occurrences of amygdaloidal andesitic lava (Ongeluk Formation).

The soils to the west of Kathu are shallow to very shallow with calcrete cropping out at the surface on the proposed development site in many places. The soils are therefore generally of the Mispah form in the study area.

This region is not suited to the production of arable agricultural products owing to the low rainfall. Consequently there is no record of any significant form of agricultural production in this area (EMPR, 2002). The shallow, rocky physical nature of the soil forms as well as the extremely high calcium and magnesium levels present, make the study site unsuitable for crop production.



Legend Roads Proposed Railway HEF plant Outer blasting zone	**Client** Sishen Mine	**Project** Sishen HEF plant / Tank Farm	N	AGES GAUTENG OFFICE 309 Glenwood Rd The Village Office Block Block E Faerie Glen Tel: +27 12 751 2160 Fax:+27 86 607 2406
	Scale 1:150 000	**Soil Types Map**		
	0 2 700 5 400 Meters	**Compiled by** C Da Camara	Version 1	
	Date 2013-12-17	**Datum** WGS 84	Projection	

Figure 5-7: Soil Types

5.6 Biodiversity

5.6.1 Griqualand West Centre of Endemism

The vegetation of the proposed development site falls within the north-eastern range of the Griqualand West Centre of Endemism (Van Wyk & Smith 2001). A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. They are extremely vulnerable; relatively small disturbances in a centre of endemism may easily pose a serious threat to its many range-restricted species (Van Wyk & Smith 2001). The Griqualand West Centre (GWC) is one of the 84 African centres of endemism and one of 14 centres in southern Africa, and these centres are of global conservation significance.

The endemic and near-endemic species make up 2.2% of the total flora, and are mostly from the Asclepiadaceae, Euphorbiaceae and Mesembryanthemaceae families. Some of the endemics are edaphic specialists, adapted to lime-rich substrates.

Endemics and near-endemics include *Searsia tridactyla, Aloinopsis orpenii, Euphorbia planiceps, Euphorbia bergii, Lebeckia macrantha, Lithops aucampiae* subsp. *aucampiae* and *Tarchonanthus obovatus*.

The GWC of endemism is extremely poorly conserved, and is a national conservation priority. Figure 5-8 shows the extent of the GWC.

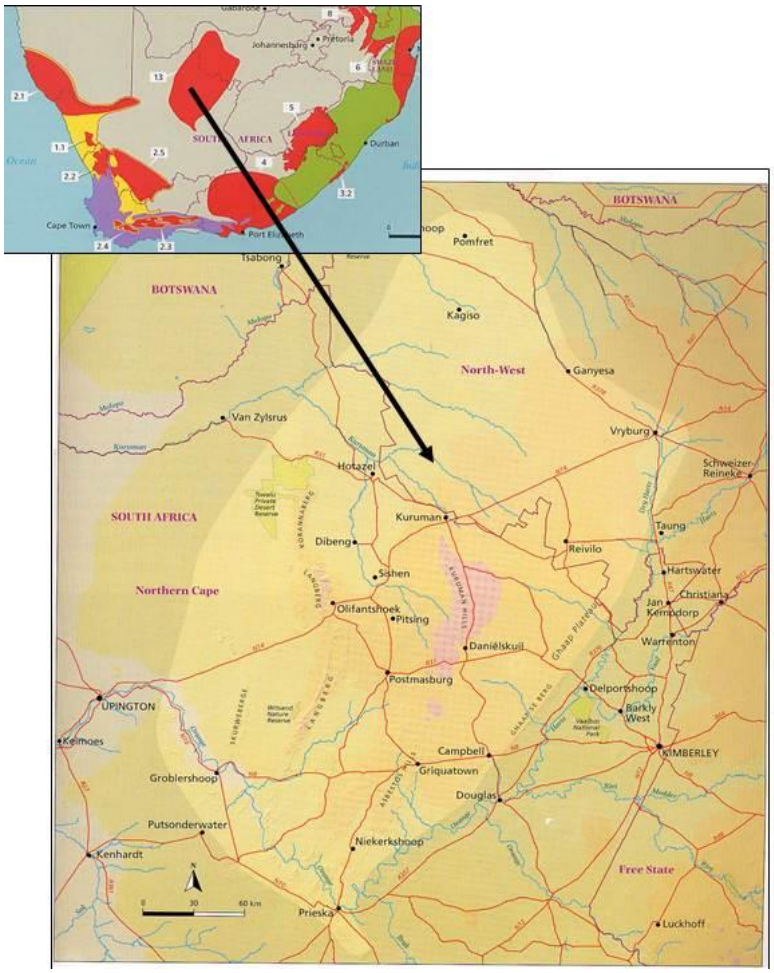


Figure 5-8: Map showing the extent of the Griqualand West Centre of Endemism (light centre). It is centred on the surface outcrops of the Ghaap Group (limestone and dolomite) and those of the Olifantshoek Supergroup (quartzite). From Van Wyk & Smith (2001).

5.6.2 Vegetation Units

The proposed development site is currently vacant land. The vegetation units on the site vary according to soil characteristics, topography and land-use. Vegetation units were identified and can be divided into 2 distinct vegetation units according to soil types and topography.

The following vegetation units were identified during the survey.

- *Acacia mellifera* shrubveld;
- Endorheic depressions (Salt pans).

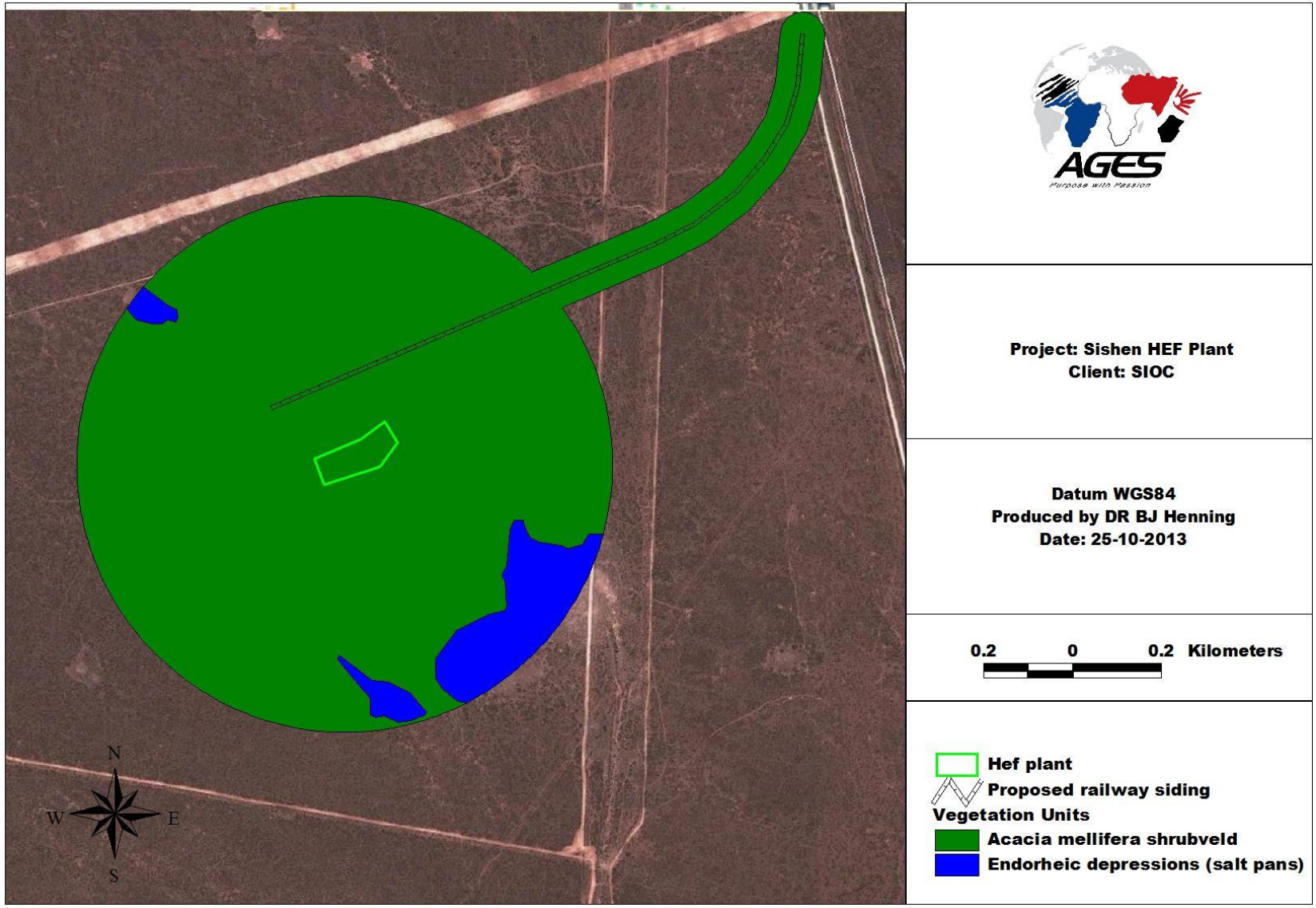


Figure 5-9: Vegetation Map of the area for the proposed HEF plant, outer blasting zone and railway siding

Acacia mellifera shrubveld

This vegetation unit is the most dominant vegetation entity in the project area and is dominated by stunted *Acacia mellifera* shrubs. Other shrubs occurring scattered through the area include *Tarchonanthus camphoratus* (camphor bush), *Diospyros lycioides* and *Searsia ciliata*. These species typically occur on shallow calcareous soils associated with limestone on the Ghaap Plateau. The characteristics of this vegetation unit are summarized in Table 5, while the state of the vegetation indicated in Figure 5-10.

Table 5: Botanical analysis and characteristics of *Acacia mellifera* shrubveld

State of the vegetation:	Slightly degraded (encroached) as a result of overgrazing in the past
Need for rehabilitation	Medium
Conservation priority	Medium-low
Characteristics	Stunted microphyllous shrubveld on shallow calcareous soils
Soils & Geology	Shallow calcareous soils derived from calcrete
Dominant spp.	*Acacia mellifera, Tarchonanthus camphoratus*
Density of woody layer	Trees: <1% (avg. height: 3-6m) Shrubs: 20-25% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 30-40% (avg. height: 0.8-1.2m) Forbs: <1% (avg. height: 0.8m)
Sensitivity	Medium - low
Red data species	None observed
Protected tree species	*Boscia albitrunca*

Figure 5-10: Stunted *Acacia mellifera* shrubveld in the project area

Salt Pan (endorheic depression)

The only natural wetland areas in the project area described as Southern Kalahari Salt Pans (Mucina & Rutherford, 2006). These pans are also known as playas. DWAF (2003) states that in order to classify an area

as a wetland it must have one or more of the following attributes:

- Hydromorphic soils that exhibit features characteristic of prolonged saturation;
- The presence of hydrophytes (even if only infrequently);
- A shallow water table that results in saturation at or near the surface, leading to the development of anaerobic conditions in the top 50cm of the soil.

This wetland type on site can be classified as a depression known as an endorheic pan. A depression is a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. Dominant hydrodynamics are (primarily seasonal) vertical fluctuations. Pans such as in the study area are flat-bottomed lack in and outlets. For this 'endorheic depression', water exits by means of evaporation and infiltration.

The Present Ecological State of the depressions was determined in a wetland delineation conducted by AGES (2013) as 'Largely Natural with few modifications', although the pans have a 'Moderate" Ecological Importance and Sensitivity. The biodiversity of the pans is not usually sensitive to flow and habitat modifications and may play a small role in moderating the quantity and quality of water.

The pans have a very limited ecological and hydro-functional importance as a result of the following:

- The Mean Annual Potential Evaporation as a result of the climatic conditions for the Kathu Bushveld vegetation type is 2883 mm which can be considered very high. The pans will therefore only keep water for a very limited period of time (2 weeks or less depending on precipitation) during the wet season (October to April);
- The geological formation associated with the pans (calcrete) show that their bases are impervious to downward (vertical) drainage. The pans form part of the shallow aquifer described in a gehydrological report (AGES, 2012). The pans are therefore not as sensitive as would be expected since it represents closed-off ecosystems with little connectivity with the groundwater.
- The biodiversity of the pans is very low and will only provide temporary foraging area to some waterfowl and larger bird species for short periods of the year depending on the availability of water in the pans. There is no specific faunal character to the pans in the project area. No rare or threatened species were found, which might be of specific conservation importance (Walmsley, 2003). The plant species diversity is less at these pans and there are few dense clusters of shrub or riparian woodland species on the pan fringes. However, a cluster of pans on the farm Woon support a localized, dense population of *Nerine laticoma*, a protected amaryllid species. This species occurs widespread throughout the area and is not necessarily only restricted to the pans.

Anderson (2003) noted that the pans could be threatened by disturbances common to other land use practices in the area, such as trampling by livestock which transforms well-vegetated pan shorelines to open mud. The Mesquite, *Prosopis glandulosa* and other alien plants could invade the pans if their spread is not controlled.

These unnatural alien thickets increase evapo-transpiration and decrease the amount of water draining into pans and lower the entire water table.

The characteristics of this vegetation unit are summarized in Table 6, while the state of the vegetation indicated in Figure 5-11.

Table 6: Botanical analysis and characteristics of the endorheic pan wetland

State of the vegetation:	Natural veld in a slightly degraded state
Conservation priority	Medium-high
Characteristics	Classified as an endorheic pan (depression) according to South African Wetland Classification System (refer to the description above). Represent short grasslands on a pan bottom. The vegetation can be described a short grasslands on pan bottoms often dominated *by Sporobolus* species, with a mixture of dwarf shrubs.
Soils & geology	The pan soil consist of white (washed) sand in shallow pans, rocky clays very rich in Na, K, Mg and are characterised by a high pH. The pan bottoms are exposed for most of the year and carry shallow pools for a short time only after good rains. Plooysburg soil form derived from calcrete
Density of woody layer	Trees: <1% (avg. height: 3-6m) Shrubs: <1% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 30-40% (avg. height: 0.8-1.2m) Forbs: 2-5% (avg. height: 0.8m)
Sensitivity	Medium -High – wetland zone
Red data species	None observed

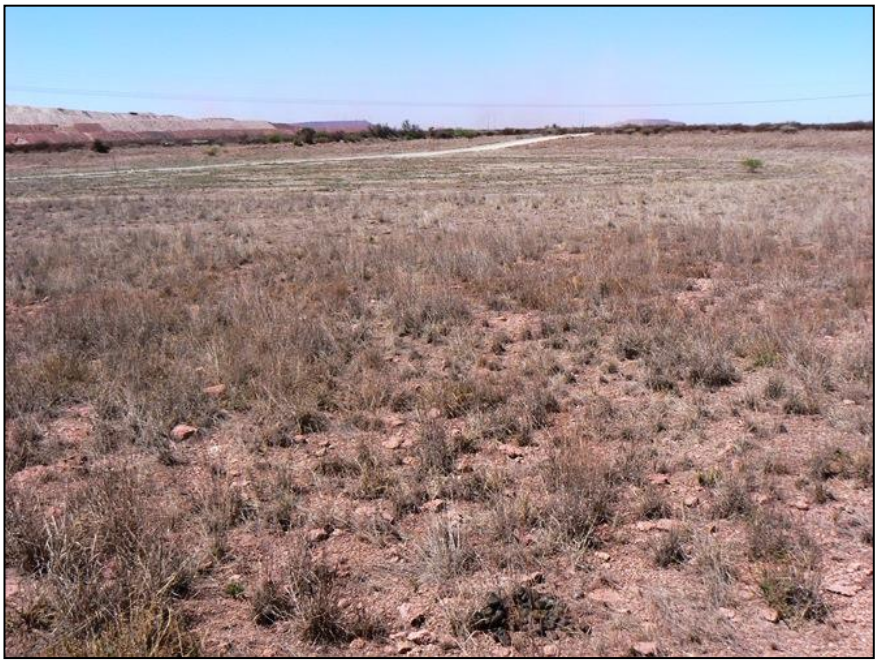


Figure 5-11: Endorheic depression (Salt pan) in the vicinity of the project area

5.6.3 Flora: Species level assessment

South Africa has been recognized as having remarkable plant diversity with high levels of endemism. The major threats to plants in the study area are urban expansion, non-sustainable harvesting, collecting, overgrazing/browsing, mining and agriculture. The objective of this section was to compile a list of plant species for which there is conservation concern. This included threatened, rare, declining, protected and endemic species.

Red data Flora Species

A list of red data plant species previously recorded in the study area in which the proposed development is planned was obtained from the Plants of Southern Africa (POSA) database of SANBI. There are various categories for Red Data Book species, such as 'Endangered', 'Vulnerable', 'Rare' and 'Near threatened' as listed in the Red Data List of Southern African Plants (Hilton-Taylor 1996). The only species listed in the POSA database potentially occurring in the area is the Near Threatened species *Eleadendron transvaalense*. No individuals of this tree species was documented during the surveys.

Endemic or near-endemic species

These species are classified as such according to the species' restricted distribution. For the purposes of this assessment this refers to species which are largely restricted to the GWC and should also be protected. Table 7 indicate the two species classified as endemic or near-endemic in the study area.

Table 7: Plant species endemic or near-endemic to the Griqualand West Centre of endemism, present in the study area

Species	Status
Searsia tridactyla	Endemic
Tarchonanthus obovatus	Near Endemic

However, as the site falls within the Griqualand West Centre of Endemism the following endemics can also occur within the area:

- Tall shrubs: *Lebeckia macrantha, Nuxia gracilis*
- Low shrubs: *Blepharis marginata, Putterlickia saxatalis, Tarchonanthus obovatus*
- Succulent shrubs: *Euphorbia wilmaniae, Prepodesma orpenii*
- Graminoids: *Digitaria polyphylla, Panicum kalaharense*
- Herbs: *Corchorus pinnatipartitus, Helichrysum arenicola*
- Succulent herb: *Orbea knobelii*

These species' habitat is mainly found on rocky areas and around drainage channels at the edge of dense scrub. No individuals of these plants were observed during the surveys.

Protected tree species (NFA)

The National Forest Act (no.84 of 1998: National Forest Act, 1998) provides a list of tree species that are considered important in a South African perspective as a result of scarcity, high utilization, common value, etc. In terms of the National Forest Act of 1998, these tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by DAFF (or a delegated authority). Obtaining relevant permits are therefore required prior to any impact on these individuals. Taking cognizance of the data obtained from the field surveys, the species indicated in the vegetation map were found during the site surveys namely *Boscia albitrunca*. A permit should be obtained from DAFF for the eradication of the species.

Protected Plants (NCNCA)

Plant species are also protected according to the Northern Cape Nature Conservation Act (NCNCA), No. 9 of 2009. According to this Act, no person may pick, import, export, transport, possess, cultivate or trade in a specimen of a specially protected or protected plant species. The Appendices to the Act provide an extensive list of species that are protected, comprising a significant component of the flora expected to occur on site. Communication with Provincial authorities indicates that a permit is required for all these species, if they are expected to be affected by the proposed project.

After a detailed survey was conducted, the following protected and specially protected plants were found in the project area:

- Protected species:

- *Boscia albitrunca* (throughout study area);

5.6.4 Fauna Assessment

A survey was conducted during October 2013 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the quarter degree square. The area represents microphyllous woodland, artificial wetlands (quarries, canals) with salt pans. Detailed fauna species list for the area is included in Appendix C1.

Avifaunal Habitat Assessment

Two major bird habitat systems were identified within the borders of the study site, including pans and microphyllous woodland.

The Savanna biome in Southern Africa supports the highest diversity of bird species of all the biomes in the sub region. This includes such characteristic and colourful woodland birds as rollers, bee eaters and waxbills, as well as large birds of prey such as vultures and eagles. The Goldenbreasted Bunting is apparently unique in being found throughout the entire woodland biome. Woodland habitat, in its undisturbed state, is suitable for a wide range of birds – in fact the woodland species are the most species rich community. Relevant to this study is the fact that many power line sensitive raptor species utilize woodland extensively. This habitat could potentially be used for foraging purposes by species such as Secretary birds and Lesser Kestrels, and Melodious Larks could also forage and breed in the lower grass layer. Lanner Falcons could use this habitat for low altitude hunting of small birds. Vulture species might also feed in this habitat if a carcass becomes available.

Woodland habitat, in its undisturbed state, is suitable for a wide range of birds – in fact the woodland species are the most species rich community. Relevant to this study is the fact that many power line sensitive raptor species utilize woodland extensively. It must be noted that large portions of the study area have been transformed, with the dominant activities being associated with cultivation, pastoralism and human settlement. As a result, a great deal of the natural vegetation within the study area has and is being transformed and subjected to severe pressure.

The conservation status of many of the bird species that are dependent on wetlands reflects the critical status of wetland nationally, with many having already been destroyed. In the study area, only small salt pans were observed. These pans are extremely important sources of water for most bird species and will be regularly utilised not only as a source of drinking water and food, but also for bathing during the summer months. The pans in this study area could also be used as flight paths for certain species. Species such as greater flamingos will utilize the salt pans in the area for foraging after heavy rainfall events, although this has not been documented in the area up to now.

The avifauna study was previously conducted for the larger area by Anderson & Wilson-Aitchison (2003). It was estimated that a total of 204 species of birds may occur in the study area, of which 119 were recorded during the assessment. As can be expected, the greatest diversity of species was found in the Khai-Apple Nature Reserve. A large number of species were also found within the project area. Many of these species are however associated with unnatural permanent water bodies within these areas.

Mammal Habitat Assessment

Antelope species such as kudu and duiker still utilize the area and are not restricted by game fences. Smaller mammal species such as honey badgers can become habituated to anthropogenic influences, while other species such as brown hyena will rather move away from the construction activities and will seldom use the area. Many of the bat species of conservation concern in the study area are cave-dependant for roosting and therefore have a low probability of being encountered in the area.

The dominant species composition therefore comprises of widespread taxa with some species having specialised life history traits. Most mammal species are highly mobile and will move away during construction. The detailed mammal species list is included in Appendix C1.

Reptiles and Amphibians Assessment

Typical species associated with arid and semi-arid habitat types occur in the study area. Venomous species such as the puff adder and cape cobra is expected to occur in the study area, although the presence of these snakes is dependant on the presence of their prey species (rodents, frogs etc.). The general habitat type for reptiles consists of shrubveld with limited available habitat for diurnally active and sit-and-wait predators, such as terrestrial skinks and other reptiles. The amphibians appear to be poorly represented on site and the pans represent the most suitable habitat for the few amphibian species that could occur in the area. No threatened species occur in the area of the proposed development.

From the study conducted by Anderson &Wilson-Aitchison (2003) it was expected that 40 reptile species and six amphibian species may be encountered within the study area. Eight reptile species and six amphibian species were recorded during the assessment. A more detailed species list of the herpetofauna expected to occur in the quarter degree square are listed in Appendix C1. Ephemeral pans provide ideal breeding grounds for amphibians.

Red data species

The following groups of species are considered to have high conservation importance and should be afforded special protection. These are species listed in the latest Red Date Lists of Mammals (Smithers, 1986), Birds (Barnes, 2000), Reptiles (Branch, 1998) and Amphibians (South African Frog Atlas Project, 2003) (Table 8).

According to the existing databases the following IUCN red data listed species could occur in the project area.

Table 8: Red data species of conservation importance in the study area

English Name	Conservation status
Bateleur	Vulnerable
Black Harrier	Near threatened
Black Stork	Near threatened
Blackwinged Pratincole	Near threatened
Blue Crane	Vulnerable
Cape Vulture	Vulnerable
Chestnutbanded Plover	Near threatened
Greater Flamingo	Near threatened
Kori Bustard	Vulnerable

English Name	Conservation status
Lanner Falcon	Near threatened
Lappetfaced Vulture	Vulnerable
Lesser Flamingo	Near threatened
Lesser Kestrel	Vulnerable
Ludwig's Bustard	Vulnerable
Marabou Stork	Near threatened
Peregrine Falcon	Near threatened
Secretarybird	Near threatened
Tawny Eagle	Vulnerable
Whitebacked Vulture	Vulnerable
MAMMALS	
Reddish grey musk shrew	Data deficient
Lesser red musk shrew	Data deficient
Black rhino	Critically endangered
Hartman's mountain zebra	Endangered
Roan antelope	Vulnerable
Brown hyaena	Near threatened
Honey badger	Near threatened
Schreiber's long-fingered bat	Near threatened
African weasel	Data deficient
Geoffrroy's Horseshoe bat	Near threatened
Darling's horseshoe bat	Near threatened
Dent's horseshoe bat	Near threatened
Bushveld gerbil	Data deficient

5.7 Noise

For the purposes of this application baseline ambient noise, surveys that have been conducted for the Sishen Mine in 2012 by Acusolv Consulting Engineers, was used.

The 14 measurement points used are depicted in Figure 5-12.

Figure 5-12: Noise monitoring locations (Acusolv, 2012)

The noise survey to determine the noise levels from the mine activities was done as close as possible to the boundary of the mine (MPs 6 to 12) and along the gravel road which separate the distant Sishen mine and the farm houses (MPs 1 to 5).

The noise impact of Sishen Mine in most of the areas to the north, east and south of the mine is still relatively low. The survey found that the noise levels at the different measuring points were in line with the recommended day time noise level of 55.0dBA. The prevailing night time noise levels are below the recommended noise level for a residential area of 45.0dBA. The higher noise levels during night time at MP14 were from the mechanical ventilation system at the new shopping centre which is north of the measuring point.

The mine does however have a more significant effect on the residents of Dingleton and in the future, is expected to have a growing impact on the nearest farms south-west of the mine. Some of these farms, in view of potential future expansions currently under consideration, lie in the proximity of the mine's axis of growth.

This and previous surveys show that ambient noise in most areas around the mine is still within acceptable levels. Dingleton is already experiencing elevated noise levels. Ambient noise levels on the nearest farms west of the mine are not currently affected significantly but are susceptible to and likely to be affected by noise from any new development in the proposed MRA (Acusolv, 2012).

5.8 Air quality

Sishen Mine operates an ambient monitoring (PM10) and dust fallout (deposition) network. The focus of the results presented here is for the three sensitive receptor areas around the mine, namely Dingleton, Sesheng and Kathu.

5.8.1 PM10 Data from the Ambient Network at Sishen

Since July 2011 Sishen Mine monitors the ambient PM10 levels at the three residential areas, Dingleton, Sesheng and Kathu by means of Beta Attenuation Mass (BAM) monitors. The annual average concentrations for the period 2011 (Q3 & Q 4), 2012 (Q1 – Q4) and 2013 (Q1, Q2 & Q3) as measured with the BAM monitors are shown in the graphs below (Figure 5-13; Figure 5-14; Figure 5-15).

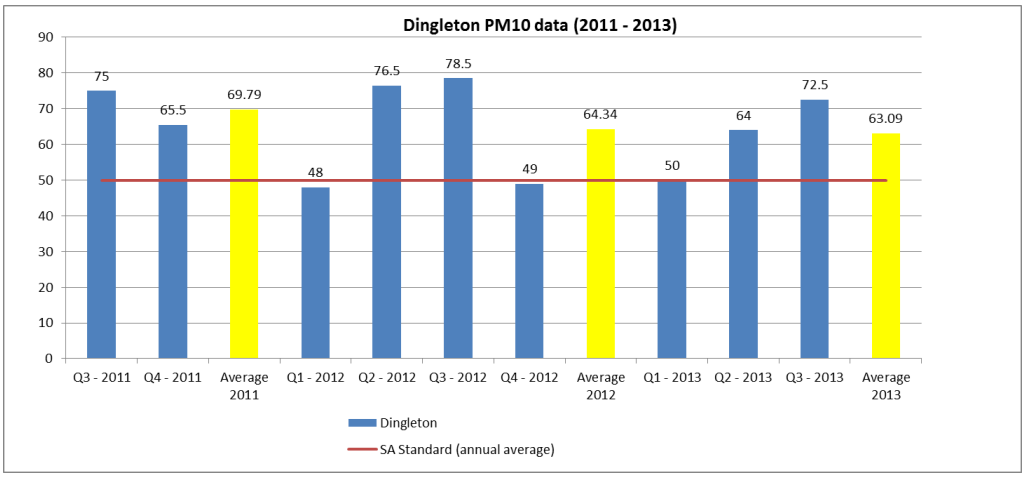


Figure 5-13: Dingelton PM10 Graph

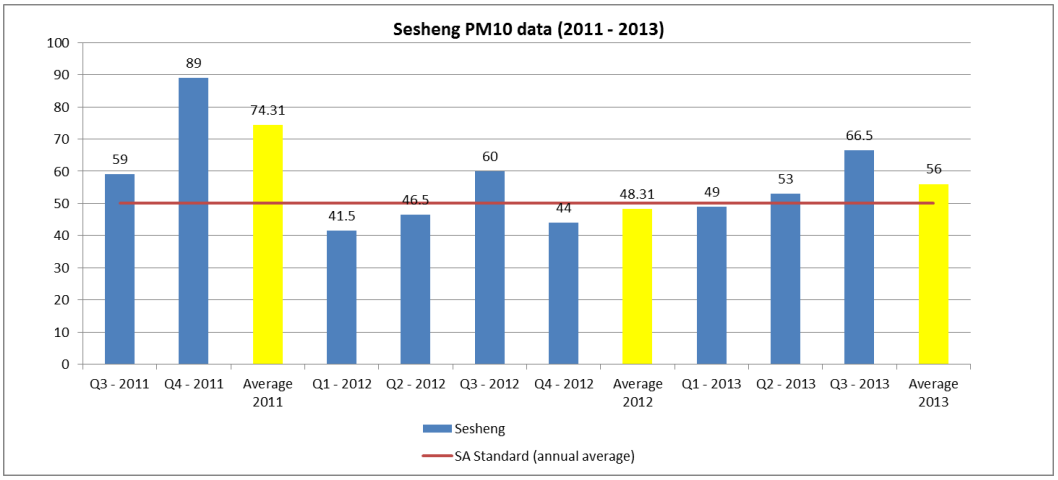


Figure 5-14: Sesheng PM10 Graph

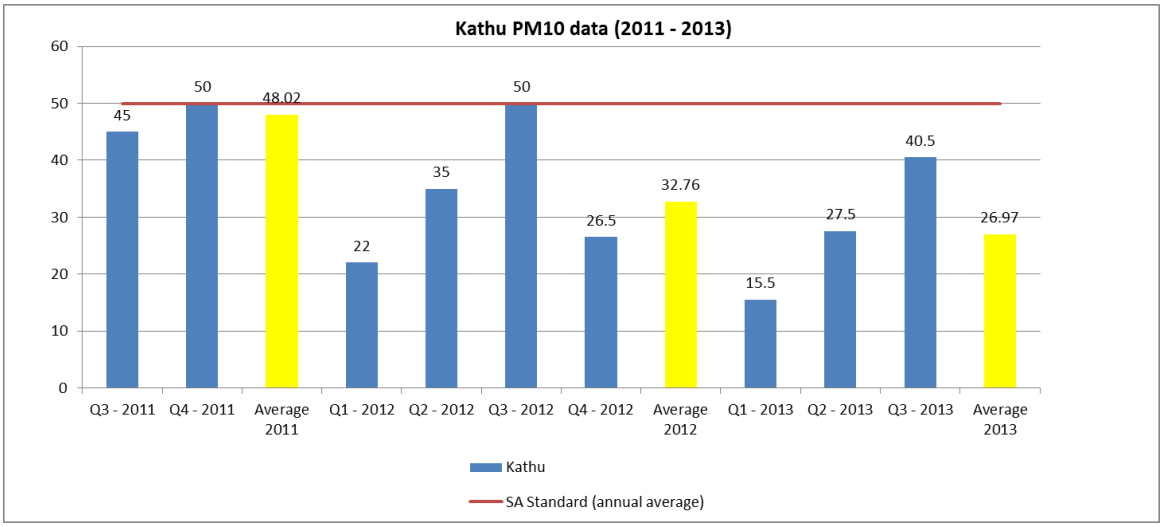


Figure 5-15 Kathu PM10 Graph

The following is evident from the above graphs:

- The average concentration measured at Dingleton in 2011 was 69.79µg/m3, in 2012 this decreased to 64.34 µg/m3 and in 2013 to 63.09 µg/m3.
- The average concentration measured at Sesheng in 2011 was 74.31µg/m3, in 2012 this decreased to 48.02 µg/m3 and in 2013 increased again to 56 µg/m3.
- The average concentration measured at Kathu in 2011 was 48.02µg/m3, In 2012 this decreased to 32.76 µg/m3 and in 2013 increased again to 26.97 µg/m3.

Dust fallout monitoring is taking place at various locations on and around the mine. The mine's dust fallout monitoring localities are indicated in Figure 5-16. Annual average dust fallout results for the period 2011 – 2013 for dust fallout monitoring stations located on the mine's perimeter are indicated in Figure 5-17.

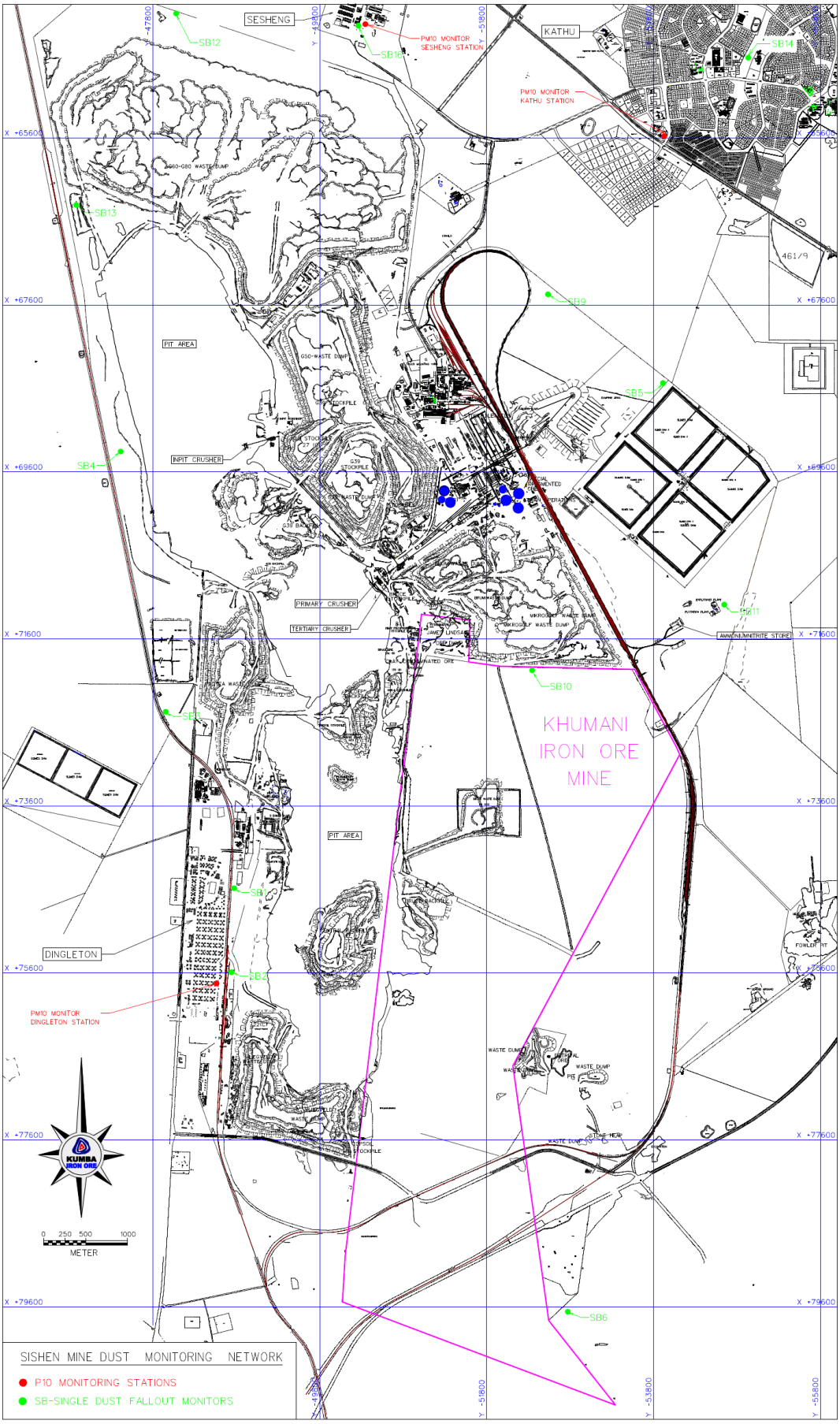


Figure 5-16 Dust monitoring network

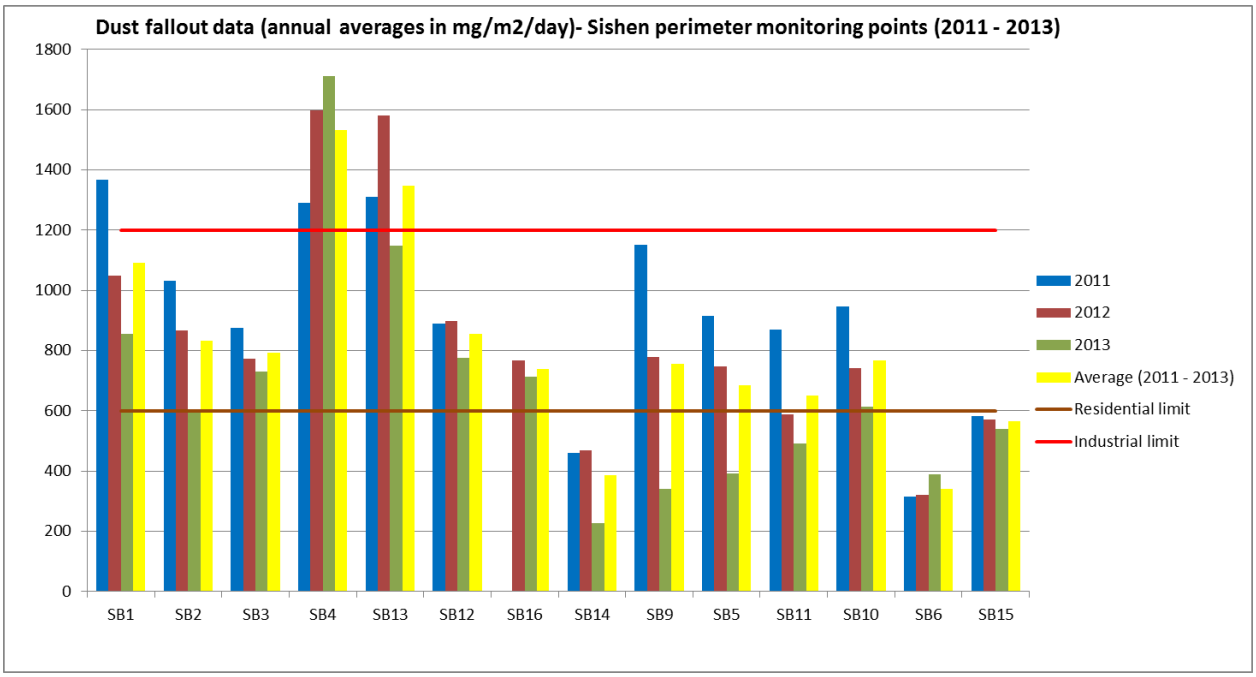


Figure 5-17 Annual average dust fallout results for 2011 - 2013

Dust fallout results are compared with the limits prescribed in GN 827 (7 December 2012). The limit value for residential and industrial areas are 600 mg/m^2/day and 1200 mg/m^2/day respectively measured over a 30-day period.

- From Figure 5-17 it is evident that the **background dust levels** as measured at SB15 (a monitoring locality on a farm approximately 10km north of Sishen Mine are high (565 mg/m^2/day).
- Two of the monitoring localities have recorded annual average values of lower than 600 mg/m^2/day.
- Nine of the monitoring localities have recorded annual average values of between 600 – 1200 mg/m^2/day.

Sishen Mine has a comprehensive dust management program in place to ensure dust levels are kept as low as possible. When considering the results provided, it is important to note that the background dust fallout results, as recorded at the Wincanton monitoring station, are generally also high.

Figure 5-18: Dingelton PM 10 Monitoring station

5.9 Sites of archaeological and cultural interest

5.9.1 The Stone Age

A small number of Middle Stone Age (MSA) occurrences were observed at three localities in the study area (Refer to Appendix C2):

- Site SA01 (S27.69176 E22.94596)
- Site SA02 (S27.69658 E22.95414)
- Site SA03 (S27.69852 E22.94908)

Two of these Stone Age sites occur in association with salt pans, one site specifically near Springbok Pan. The artefact scatters are mostly constituted out of debris flakes but single formals stone tools such as side scrapers, points and blades produced on fine grained specularite, jaspilite and banded iron stone, were recorded. Some of the tools display secondary retouch. Similar Stone Age scatters occur frequently in this area along the banks of the Gamagara River and around water pans and these sites has been the subject of detailed archaeological research studies3. The locations of Stone Age scatters in the Sishen area correspond with a general regional Stone Age site distribution pattern where archaeological sites in the landscape occur near water sources close to local sources of rare raw materials in lithic manufacture.

[3]E.g. Kruger, N. 2012, Beaumont, P. 2009, Van Der Ryst 2012.

Figure 5-19: View of Site SA01 along the outer fringes of a small salt pan

The deposition pattern and stratigraphy as observed at these sites and elsewhere in erosion gullies and around pans imply that the lithic scatters in this landscape occur mainly as a single horizon within a shallow superficial calcrete formation. Typologically, the artefacts can tentatively attribute to the Middle Stone Ages when compared to similar recorded assemblages in the area (e.g. Beaumont & Morris 1990). The sites are of limited significance due to the low density of formal tools, as well as the general loss of artefact context and shifting of artefacts due to natural processes.

Figure 5-20: Lithics on fine grained stone from Site SA01.

Figure 5-21: Secondary retouch visible on side and end scrapers from Site SA03

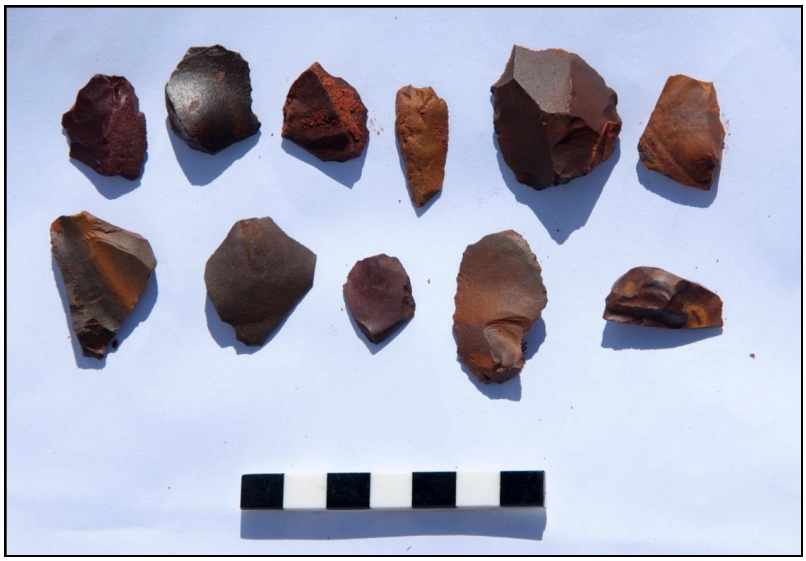


Figure 5-22: Typical fine grained MSA lithics from MSA scatters in the Gamagara area.

Figure 5-23: Lithics from Site SA02. Note single side scrapes (photo left), weathered point (photo right, left) and a blade (photo right, right).

5.9.2 The Iron Age Farmer Period

No Iron Age (Farmer Period) occurrences were observed in the survey area.

5.9.3 Historical / Colonial Period and recent times

Site HP01 (S27.68998 E22.95362)

The dilapidated ruins of the old Woon farmstead occur to the north-east of the study area. At the site, a single section of mud brick wall, farmstead implements, a concrete dam and a wind mill remains. The farm Woon was proclaimed in 1908 (see Figure 5-24) and it could be assumed that the farmstead dates to this period. Even though the farmstead and associated features are therefore older than 60 years, the site is probably of limited significance due to the general poor preservation of structures and features.

Figure 5-24: The dilapidated mud brick walls of the Woon farmhouse.

5.9.4 Graves

No graves / burials were observed in the survey area.

5.10 Visual Environment

The surrounding vegetation in the Sishen area is mostly comprised out of mixed grasslands and scattered trees with the occurrence of semi-arid succulents in places. Refer to Figure 5-25, Figure 5-26, Figure 5-27, and Figure 5-28 for photographs taken on site.

Figure 5-25: View of the existing Transnet railway line at the site of the proposed HEF rail link connection.

Figure 5-26: View of general surroundings in the study area, looking south.

Figure 5-27: View of a small salt pan in the vicinity of the study area, looking west.

Figure 5-28: View of the proposed HEF plant site, looking east towards the Sishen Mine.

5.11 Socio-Economic Environment

According to a Social Study conducted as part of the Western waste Rock Dumps study (2012) the following information was used.

Sishen mine is located in the Northern Cape Province in the John Taolo Gaetsewe District Municipality (JTGDM) and the Gamagara Local Municipality. The Northern Cape is South Africa's largest province, covering an area of 361 830 km^2, representing 29.7% of South Africa's land mass. The province is divided into five administrative districts, namely Siyanda, Pixley Ka-Seme, Namaqua, Frances Baard and Kgalagadi, currently known as the John Taolo Gaetsewe District. The major towns in the province include Kimberley, De Aar, Kuruman, Upington, Calvinia and Springbok (John Taolo Gaetsewe District Municipality, 2012).

The JTGDM covers an area of 27 283 km^2 and is made up of the Kgalagadi District Management Area as well as the Gamagara, Ga-Segonyana and Moshaweng Local Municipalities. Sishen Mine falls within the Gamagara Local Municipality. Towns within the Gamagara Local Municipality's area of jurisdiction include Kuruman, Kathu, Dibeng, Olifantshoek, Hotazel, Black Rock and Van Zylsrus (John Taolo Gaetsewe District Municipality, 2012).

The main industries in the municipal area include mining, agriculture and tourism. While Agricultural activities focus on cattle and goats, game farming and hunting are increasing in popularity (Aucamp, 2010). The area is sparsely populated and characterised by vast open spaces with significant underground deposits of manganese and iron ore, the latter being the most prominent commodity in Gamagara's mainstay economic sector, which is mining (www.businesswomen.co.za).

The Gamagara Local Municipality is the geographically the smallest municipal area within the District Municipality and has the second smallest population size in the area. The primary land uses include mining (iron ore and manganese) and agriculture (cattle and goat farming). Water is supplied to the municipality by the Sishen Mine as a result of dewatering of the mining pits (Ptersa, 2011).

Kathu is one of the youngest towns in South Africa, founded in 1974 and owes its existence to the Sishen Mine. Kathu is often promoted as the 'Town under the Trees' because of its location in the Kathu 'Bos' (forest), which is famous for its Camel thorn trees. The town came into being as a result of the iron ore mining activities of the then ISCOR in the area and came into being only a few decades ago. The town has a circular form with residential areas surrounding the CBD, which is located in the centre of town (Kgalagadi District Municipality, 2007). In Sesheng, just outside Kathu, residential use is characterised mainly by hostels for mine workers.

Approximately 85% of the population of Kathu and Dingleton is associated with Sishen Mine and related industries. This includes employment in the various support services and trades. The other 15% of the population functions to cater for the needs of the affiliated community that include employment in shops, banks, garages, and other retail facilities. The municipality of Kathu similarly employs a notable percentage of the population.

The Sishen mine is one of the largest opencast iron mines in the world, and is the Northern Cape's largest employer (www.northerncapebusiness.co.za), and a major trainer of artisans in South Africa. Having identified skills shortages as one of the key hindrances to economic growth in the area, Sishen Mine boasts one of the few

fully accredited institutions in South Africa that provides outstanding theoretical and practical training (www.kumba.co.za). The sheer scale of the mine means it has a significant impact socially, environmentally and economically. The mine recognises its role in the community and it works closely with local and district municipalities and other stakeholders to participate in the integrated development plan (IDP). The mine is owned by Anglo American Kumba Iron Ore, which is an Anglo American plc company, and has an approximate workforce of 16 695 who work in three eight hour shifts, six days a week (www.northerncapebusiness.co.za; www.dwaf.gov.za).

The population in the Gamagara area has increased with almost a fifth since 2001 and as the Sishen mine is the largest employer in the area, it is likely that the increase in population is due to an increase in mining activities.

The province faces a number of societal challenges that predominantly emanate from the effects of poverty (Kgalagadi District Municipality, 2007). These challenges include reducing the backlog in services relating to basic needs such as water, sanitation and housing; access to health, education and social services; the prevalence of HIV and AIDS; creating of opportunities for employment; reducing crime and addressing the needs of vulnerable groups (Aucamp, 2012).

The population of towns in Gamagara Local Municipality is tabled below (Table 9):

Table 9: Population of Towns in the Gamagara Local Municipality

Local Towns	Population
Deben (Dibeng)	4900[$]
Dingleton	2487[$]
Kathu	9266[$]
Sesheng	1898[#]
Olifantshoek	8242[$]
Mapoteng	2095[$]
$ Source: http://www.dwaf.gov.za/dir_ws/WaterServices/reports # Source: Census 2001	

Dingleton was built in the 1950s by the Sishen Mine to house its workers (KIO, 2009) and was previously known as Sishen (www.businesswomen.co.za). It was developed in a linear form all along the one side of the then main road between Upington and Kuruman (Kgalagaldi District Municipality, 2007). The town is surrounded by large mine activities and the resettlement of Dingleton's residents is eminent due to the expansion of the mining activities in this direction.

5.11.1 Population

The growth rate in the Northern Cape Province is lower than the national average. The John Taolo Gaetsewe District Municipality (JTGDM) shows a decline in population size since 2001 and this can most likely be ascribed to the closure of some of the asbestos mines in the district as well as the prevalence of HIV/AIDS (although it is

well below the national prevalence rate). Negative growth is estimated for the area between 2005 and 2015 for both high and low growth scenarios (Kgalagadi District Municipality, 2007). The population in the Gamagara area has increased by almost 20% since 2001 and as the Sishen Mine is the largest employer in the area, the increase is in all likelihood due to an increase in mining activities (Ptersa, 2011).

In 2011 the Gamagara area had an average household size of 3.85, the highest of the three levels (provincial, district and local) under investigation. The household sizes on provincial and district level have also decreased slightly.

The population distribution of the Gamagara area shows greater similarities with the Northern Cape Province than with the JTGDM. 40% of the population of the Northern Cape Province belong to the coloured population and almost 50% to the black population group. In the JTGDM just over 80% belong to the black population group. This can be ascribed to the large presence of tribal land in the district. In Gamagara the black population makes up just over 55% of the population with only about 28% of the population belonging to the coloured population. Gamagara has proportionately the most people from the white population with about 14% of the population being white. This is most likely due to the presence of the Sishen Mine as the largest employer in the area. Technical expertise and tertiary education is required for many jobs in mining operations. People from the white population group had a historical advantage in acquiring the technical skills and tertiary education required for some of the jobs (Figure 5-29).

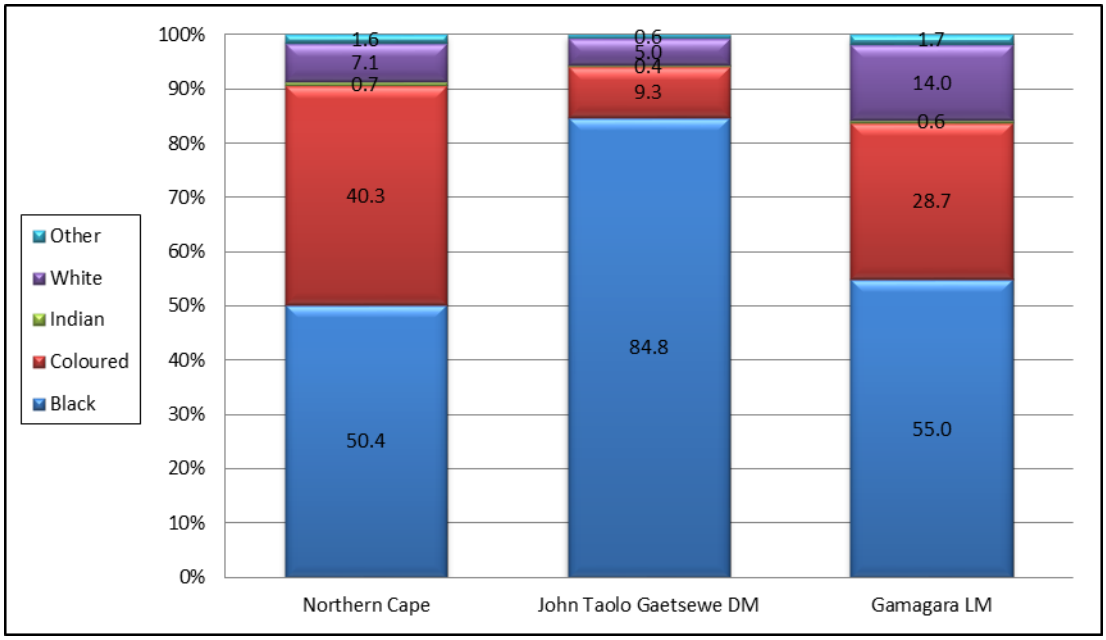


Figure 5-29: Population distribution (shown in percentage, source: CS 2011)

5.11.2 Age

The average age in Gamagara (28.87 years) is much higher than that of the district but just slightly lower than the average age of the province. The average age in the JTGDM is much lower than on provincial or local level. This can most likely be ascribed to the large tribal areas in the district where many people from economically active

age migrate to other areas in search for work in order to support their families, while children and older people stay behind (Figure 5-30).

The age distribution profile of Gamagara is very similar to that of the Northern Cape Province with about 25% of the population being younger than 15 years and 72% of economically active age (aged between 15 and 64 years). In the JTGDM a smaller proportion of people from economically active age (592%) than in the other areas has to take care of children who make up almost a third of that population. This put more strain on those who are economically active.

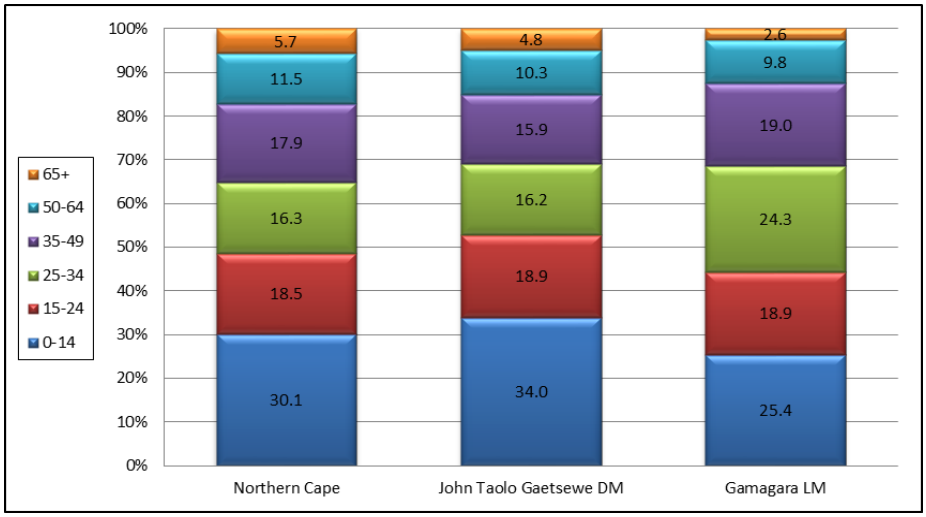


Figure 5-30: Age distribution (shown in percentage, source: CS 2011)

The large proportion of people below the age of 15 years in the district indicates a greater future demand for employment and infrastructure. More work seekers can migrate from the rural areas to the more urbanised areas in the district such as Kuruman and Kathu in search of job opportunities.

5.11.3 Gender

On provincial level the gender distribution is more or less equal (Figure 5-31), but in the JTGDM there are much more females than males. This is due to the large portions of tribal land in the district where many males have migrated to other areas in search of employment.

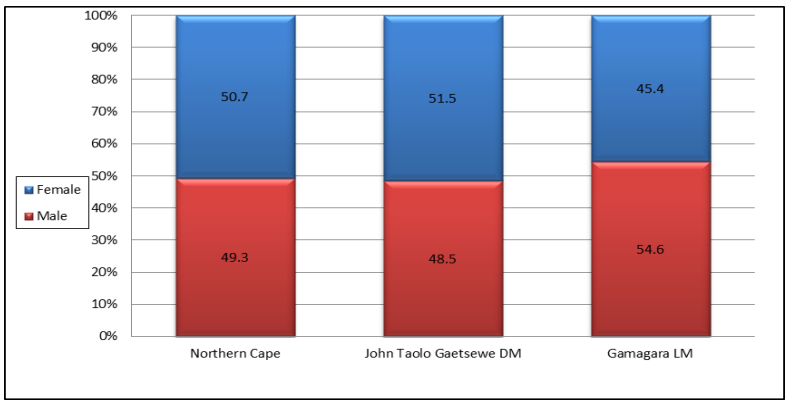


Figure 5-31: Gender distribution (shown in percentage, source: CS 2011)

In the Gamagara area there are more males than females, which can be ascribed to the extensive mining activities in the area. Traditionally mine workers tend to be male.

5.11.4 Language

The Census 2011 data for language was used to get an indication of the language distribution in the area. The language distribution of the Gamagara area is very similar to that of the Northern Cape Province (Figure 5-32) with Afrikaans being the home language of more than 50% of the people and Setswana the home language of about a 30% of the people.

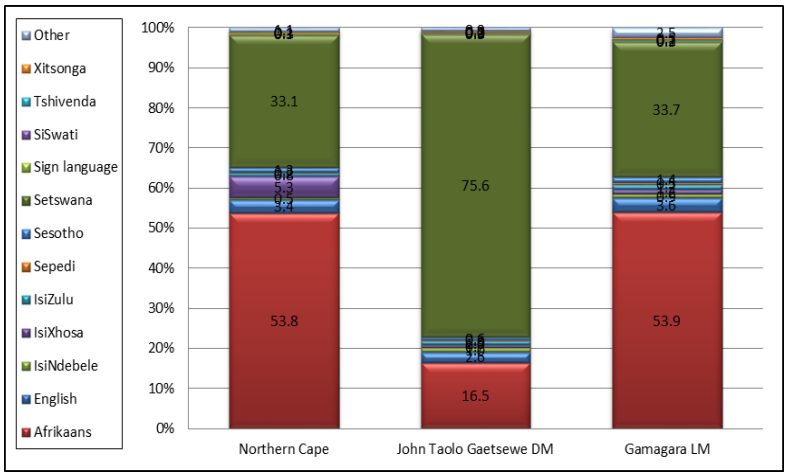


Figure 5-32: Language distribution (shown in percentage, source: Census 2001)

More than 70% of the people in the JTGDM district have Setswana as home language, indicating that this district is culturally very different from the other areas under discussion. The district borders Botswana and the greatest part of the population in the district live in tribal areas where mainly Setswana is spoken. All the tribal land in the Northern Cape is situated in the JTFDM.

5.11.5 Education

The education profile for people 20 years or older in the Gamagara area is very similar to that of the Northern Cape with the exception that Gamagara has a greater proportion people with tertiary education and less people who stopped their education at Grade 12. This can be ascribed to the nature of skills required by the Sishen mine as the largest employer in the area. Educational facilities in the area include a training college and six schools (Kgalagadi District Municipality, 2007).

Education Deprivation is one of the domains of multiple deprivations that were used to calculate the Provincial Indices of Multiple Deprivation (Noble et al, 2006). There is a close link between educational attainment, the type of work an individual is engaged in and the associated earnings potential. The level of education achieved by an individual determines current income and savings potential, as well as future opportunities for individuals and their dependants. This does not bode well for the JTGDM, as the education levels in the area are generally low.

5.11.6 Income

More than 60% of the people of economically active age (aged between 15 and 65 years) in the JTGDM district have no personal income. The absence of personal income can be linked to historical educational deprivation (Noble et al, 2006). The Gamagara area is more affluent than the district or the province with more people earning in the higher income categories.

5.11.7 Economic Development

The importance of mining and mineral processing, in particular iron ore and manganese, driving economic development along with the agricultural, manufacturing, and tourism activities and is recognised by various provincial policies. The District Municipality's strategic documents further highlight the integral nature of the mining sector's development in ensuring sustainable livelihoods of the local communities and improving their standard of living. The SIOM itself is seen as a cornerstone of further expansion of the mining sector in the area. However, the strategic document call for the greater management of negative impacts associated with the mining activities, such as road congestion, road condition deterioration, and air pollution. A great emphasis is also made on the need to diversify the local economies to reduce the dependency on the mining activities' volatile nature and increase the sustainability of local communities, as well as on the need to perform more stringent environmental management and land use management. Overall, it can be concluded that the proposed project is in line with the local, provincial, and national developmental priorities; however, issues regarding negative impacts associated with mining activities will need to be taken into account (Urban-Econ, 2012).

Sishen Mine is one of the largest contributors to the economy of the Northern Cape. Sishen Mine's Social and Labour Plan was compiled with the Local Economic Development (LED) strategies and Integrated Development Plans (IDP) of the Gamagara Local Municipality and the John Taolo Gaetsewe District Municipality as a guide. The Social and Labour Plan outlines Sishen Mine's commitment to contributing to the socio-economic development of its employees and the surrounding communities.

Unemployment remains one of the major challenges in some of these areas. The level of unemployment in communities around the mine differs due to skill and education levels. Kathu and Sesheng, both located closest to the mine, have the highest number of employed persons per household; Deben and Mapoteng have the highest number of households with at least one person unemployed compared with other towns.

5.11.8 Health

In communities around the mine, the prevalence of HIV and AIDS and other diseases is high. This is especially noticeable in informal settlements and poorer rural communities. In this regard, the mine is committed to addressing these issues by developing and implementing a comprehensive HIV and AIDS programme.

Despite the effort that all tiers of government have put in place in terms of investing in primary and secondary health care facilities, access to these facilities by poorer communities remains a hurdle.

5.11.9 Tourism

Tourism in the vicinity of Sishen Mine consists mainly of a variety of guesthouses catering largely for business. There are various guest / game farms in the area that offer hunting. However, there are no established guest farms / houses on any of the private farms directly adjacent to the mine.

5.11.10 Activities immediately adjacent to the site

There are a number of privately-owned farms located to the west of the site. Based on the survey conducted during March 2012 (Urban Econ), the dominant activity on the farms is cattle grazing with an average grazing capacity of 9ha per animal. According to the District's Spatial Development Framework 2012 (SDF), the average grazing capacity of the land in the area is estimated to be even lower and range between 14 and 17 ha per animal.

In addition to cattle grazing, some farmers carry stock of sheep (about 30% of farms) and game (about 60% of farms). Game farming, though, is not the commercial business on the farms, except for one farm, and does not comprise the primary income generating activity. Game kept on the farms largely includes antelope which roam in the same territory as cattle. It is used for biltong hunting by farmers themselves as well as small numbers of domestic biltong hunters.

Semi-arid climate and subsequent climate change effects are considered to be one of the greatest factors affecting the potential of the agricultural activities in the municipality, including the area next to the SIOM. The problem though is exacerbated by the decreasing levels of underground water table, due to the fact that its extraction by various users is not appropriately replenished by precipitations and transfers from other catchments (JTG DM, 2012).

6 ALTERNATIVES

6.1 Overview

Regulation 28(1) (j) of the NEMA Regulations (GNR 543) require that an environmental investigation needs to consider feasible alternatives for any proposed development. Therefore, the DENC requires that a number of possible proposals or alternatives for accomplishing the same objectives should be considered.

6.2 Process to assess alternatives

In the case of the proposed HEF Plant development, possible alternatives will be identified through discussions with authorities, discussions with I&AP's, reviewing of existing environmental data, specialist inputs/studies and discussions with the client. The alternatives will be assessed in detail in the EIA Report.

Some of the alternatives that will be assessed include:

- Technology alternatives;
- Locality alternatives,
- Status quo / no-go alternative

6.2.1 Technology alternatives

The alternative to a HEF plant is a Tank Farm, where the HEF would be stored in tanks as opposed to being manufactured on site. The Tank farm was considered as an alternative to store HEF that is manufactured off site at the manufacturing facilities in Gauteng. It would typically consist of bulk storage vessels to store the HEF product. HEF stored in this manner have a shelf life of 6 months.

The option that was decided on by Sishen Mine was to rather construct their own HEF manufacturing facility where all the raw materials are outsourced and stored on site. The raw materials would be mixed on site to create HEF. Sishen mine has already been manufacturing HEF for the past 30 years.

6.2.2 Locality alternatives

The current explosives facility, consisting of a HEF plant, explosives magazines, ANPP store and all related infrastructure is situated near the slimes dams at Sishen Mine.

This area is now required for the construction of the following:

- Expansion of slimes dams
- Waste beneficiation plant

- Concentrator plant
- Low grade ore plant
- Rail loop
- Plant waste dump
- New substation and ESKOM power line

The current position of the explosives facility will prevent the construction of the required facilities and therefore a new facility need to be constructed as described above.

6.2.3 No-Go Alternative

One of the options to be considered as part of the EIR is that of the no development option. This would entail leaving the site in its present state and not developing the proposed HEF plant or any of the proposed alternatives. This option will prevent the expansion of the tailings dam, waste beneficiation plant and other infrastructure as mentioned above (Section 6.2.2). This option will be evaluated further during the EIA phase.

7 ASSESSMENT OF IMPACTS

7.1 Introduction

A key outcome of the Scoping process is the identification of the impacts resulting from the proposed development. *The reader should note that the classification of an issue as a key issue during the scoping phase does not necessarily imply that a significant impact will result. The significance of an impact can only be ascertained once a specialist study has been conducted.*

Impact significance will be assessed during the specialist studies and impact assessment phase using the criteria listed below.

7.2 Identification of Key Issues

The key issues listed in the following section have been determined through the following avenues;

- Views of interested and affected parties,
- Legislation,
- Review of the relevant literature, mapping and digital resources, and
- Professional understanding of the project team, environmental assessment practitioners and specialist consultants involved at this stage of the impact assessment.

Further details associated with the construction and operation of the various activities as listed in the project description will be discussed in detail in the EIA Report. The EIA report will assess the impacts of each of the activities, as well as ascertain the cumulative impacts of the development. The report will also outline the necessary mitigation measures to limit the impact to the environment.

During the Scoping public registration and comment period no concerns were received from Interested and Affected Parties, however expert judgement from the project team revealed the following key aspects that will require further investigation:

- Ecological and heritage impacts
- Possible water quality impacts due to spillages or leakages
- Traffic impact

7.3 Specialist Studies

As a result of the above-mentioned key aspects, the following specialist studies will be undertaken during the EIA phase of the project (also refer to Appendix D: Plan of Study for EIA):

- Hydrogeological study

- Traffic Study
- Air quality assessment, depending on the requirements of the Municipality following submission of the Air Emissions License amendment,
- Ecological Assessment (completed) and
- Heritage Assessment (completed).

7.4 Assessment Methodology

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need. Assessment of impacts will be based on DEAT's (1998) Guideline Document: EIA Regulations. The significance of the aspects/impacts of the process will be rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrixes use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

The significance of the impacts will be determined through a synthesis of the criteria below:

Probability. This describes the likelihood of the impact actually occurring.

Improbable:	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable:	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable:	It is most likely that the impact will occur at some stage of the development.
Definite:	The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.

Duration. The lifetime of the impact

Short term:	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium term:	The impact will last up to the end of the phases, where after it will be negated.
Long term:	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
Permanent:	Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale. The physical and spatial size of the impact

Local:	The impacted area extends only as far as the activity, e.g. footprint
Site:	The impact could affect the whole, or a measurable portion of the above

mentioned properties.

Regional: The impact could affect the area including the neighbouring residential areas.

Magnitude/ Severity. Does the impact destroy the environment, or alter its function.

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

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

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

Significance. This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.

Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.

Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.

High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights will be assigned to each attribute:

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2

	Medium	6
	High	8
Significance	**Sum(Duration, Scale, Magnitude) x Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity will be rated without mitigation measures and with mitigation measures for both construction, operational and closure phases of the proposed development.

7.5 Impact Assessment

Impacts on the identified key issues will be assessed according to the following structure:

- *Source of the impact*: will be identified (e.g. initial vegetation clearance on site, passage of vehicles on dirt roads, etc).
- *A Description of the impact* will describe the interaction between the activity and the environment, i.e. how and why the impact occurs and how the activity changes the environment.
- *Significance:* an explanation of the significance rating of the impact with and without mitigation, with reference to the impact assessment criteria will be provided. Impacts will be rated as highly significant, or of low significance. Fatal flaws will additionally be identified. There are no mitigation measures which can be implemented to manage a fatal flaw.
- *Mitigation:* The mitigation measures that can be implemented to eliminate or minimise negative impacts or result in the optimization of positive benefits must, wherever possible, will be expressed as practical actions.

7.6 Plan of Study (PoS) for EIA

As per the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended and the Environmental Impact Assessment Regulations of 2010 No. (28)(1)(n), a PoS for EIA is required. The plan of study for environmental impact assessment sets out the proposed approach to the environmental impact assessment of the application (Appendix D)

8 CONCLUSION AND RECOMMENDATIONS

This Scoping Process has followed the correct and appropriate standards and procedure for this EIA application, as set out in the NEMA (amended), and the EIA Regulations of 2010. The Scoping Study includes an analysis of various alternatives and indicates those alternatives, which should be pursued as part of the detailed assessment during the EIA process.

Terms of Reference for specialist studies were formulated taking into consideration comments received during the public participation process to date. These terms of reference ensure that potential environmental impacts are adequately investigated during the detailed assessment phase of the EIA process and that any relevant shortcomings and/or gaps are addressed.

Impact significance will be assessed during the specialist studies and impact assessment phase using the criteria listed in Section 7.

Public participation during the Impact Assessment Phase of the EIA will revolve around a review of the findings of the EIA and inputs into the Environmental Management Plan (EMP). The findings will be presented in a Draft Environmental Impact Assessment Report and EMP and the volume of specialist studies. AGES Gauteng recommends that the project proceed into the EIA phase of the environmental process. The EIA report will address the key issues identified in the scoping report, at a level required to provide the public and the decision making authorities with sufficient information to deliver a final decision.

The anticipated way forward on the next phase of the EIA process is explained below in Section 8.1.

8.1 The Way Forward

1. **Appointment of Specialists**. The specialists have been appointed to undertake the specialist studies identified in the Scoping Report.
2. **Draft Scoping Report**. The Draft Scoping Report was placed on review for registered IAPs.
3. **Final Scoping Report**. Following the Draft review the Scoping Report has been updated with comments received, and submitted to the DENC and IAPS.
4. **Draft Environmental Impact Report.** The results of the specialist studies will be synthesized by the project team to provide a draft EIR.
5. **Draft EIR published.** The draft EIR will be made available to the DENC and the registered interested and affected parties in line with the comment periods described in the 2010 NEMA regulations. The findings will be summarised and included in the final EIR.
6. **Comments Report.** Comments on the Draft EIR will be synthesized by the project team into a comments report, which will be appended to the final EIA Report.
7. **Revise draft EIR.** The draft report will be updated by addressing and responding to the

issues raised in the Comments Report. Responses from the proponent to key issues will also be included.

8. **Final EIR.** The revised final report will be compiled with the various specialist reports appended. This will be submitted to the interested and affected parties, and to the DENC for a decision with respect to the proposed development.

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10 APPENDIX A: COMMENTS AND RESPONSE REPORT

11 APPENDIX B: CORRESPONDENCE FROM DENC

12 APPENDIX C: SPECIALIST REPORTS

12.1 C1: Ecological assessment

12.2 C2: Archaeological Assessment

13 APPENDIX D: PLAN OF STUDY FOR EIA