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ENVIRONMENTAL

Name of Applicant:	**Lanxess Chrome Mining (Pty) Ltd**
Telephone Number:	**014 536 0600**
Fax Number:	**011 536 3997**
Postal Address:	**P.O. Box 8, Kroondal, 0350**
Physical Address:	**Farm Rietfontein 338 JQ, Bleskop, Rustenburg, 0292**
File Reference Number SAMRAD:	**TBC**

Environmental Impact Assessment and Environmental Management Programme Report for Lanxess Chrome Mine

Section 102 Amendment

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

August 2015

mineral resources
Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Digby Wells and Associates (South Africa) (Pty) Ltd
(Subsidiary of Digby Wells & Associates (Pty) Ltd). Co. Reg. No. 2010/008577/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	**Section 102 Amendment**
Project Name:	**Environmental Impact Assessment and Environmental Management Programme Report for Lanxess Chrome Mine**
Project Code:	**LAN3111**

Name	Responsibility	Signature	Date
Riaan Swemmer	Report Writer		June 2015
Stephanie Aken	Project Manager		June 2015
Grant Beringer	Project Sponsor		June 2015

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002 as amended) (MPRDA), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme (EMPr) report in terms of the National Environmental Management Act, 1998) (Act No. 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the Environmental Impact Assessment (EIA) Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- Determine the:
    - Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    - Degree to which these impacts:
        - Can be reversed;
        - May cause irreplaceable loss of resources, and
        - Can be avoided, managed or mitigated.
- Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- Identify suitable measures to manage, avoid or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Introduction

Lanxess Chrome Mine (the Mine or LCM) is a well-established chrome mine in the Rustenburg area. Currently only the underground mining of chrome is taking place at the site.

Lanxess Chrome Mining (Pty) Ltd (Lanxess) has proposed an amendment to its mine plan by extending the existing underground chrome operations into neighbouring properties as well as the establishment of an open pit mine within its existing mining right area.

The proposed project will be required to comply with the provisions of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and the Environmental Impact Assessment Regulations, 2014, (GN R982 of 4 December 2014) promulgated in terms of Sections 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

Lanxess currently has an approved Environmental Impact Assessment and Environmental Management Plan (EIA/EMP) in line with the MPRDA which covers various portions of the farms Kroondal 304 JQ, Rietfontein 338 JQ and Klipfontein 300 JQ. As such, Lanxess would need to amend the existing EIA/EMP to include the details of the proposed open pit mining operations on the farm Rietfontein 338 JQ as well as the extension of the underground sections (Segment 1, 2, 3 and 4) on portions of the farms Kroondal 304 JQ, Klipfontein 300 JQ and Brakspruit 299 JQ. The substantial changes to the existing mining areas also requires a Section 11 transfer in terms of the MPRDA to cede the Mining Rights held over the 4 segments by Glencore Operations South Africa (Pty) Ltd (GOSA) to Lanxess. The Section 102 Amendment will include the expansion of the underground operations into the following four segments:

- Segment 1 (Kroondal area);
- Segment 2 (Amplats Operational Area (AOA));
- Segment 3 (AOA); and
- Segment 4 (Wonderkop area).

It is assumed that no surface related infrastructure will be constructed on the 4 segments and that access to underground workings will be gained using existing infrastructure on LCM current Mining Right area.

The consent of the Minister of Mineral Resources (DMR) to effect these amendments will be sought in terms of the provisions Section 102 amendment under the MPRDA. At the same time, the consent of the Minister to amend the mining work programme as well as the Social and Labour Plan to deal with the amendments to the mine plan will be sought. This Report does not however deal with amendment of the mining work programme or Social and Labour plan.

The purpose of this Report is to describe and assess the environmental impacts of the proposed mine extensions only (including the listed activity of the construction of haul roads) and does not deal with the existing, authorised mining activities. However, for the purposes of holistic site management and ease of auditing, the EMP will be presented as a consolidated document and incorporate where relevant elements of the existing approved EIA/EMP.

Project Applicant

The Mine has a reputation as being a supplier of high quality chrome ore. The Mine is run by Lanxess' Leather business unit and supplies in particular company sites in South Africa and Argentina that process the raw material into chrome chemical intermediates and finally into products for amongst others the manufacture of leather. It is situated approximately 14 km from the town of Rustenburg in the North West Province. The Mine is part of a mineral deposit known as the Bushveld Igneous Complex which holds the majority of South Africa's chrome ore deposits.

The ore is crushed underground and brought to the surface by a system of conveyor belts. On surface it is processed to yield a chemical concentrate, the raw material for Lanxess' chrome chemicals plants, lumpy ore and metallurgical concentrate the raw material for the ferrochrome industry, as well as foundry sands which is used in metal foundries.

The Applicant's details are set out in the Table I below.

Table I: Applicant's details

Company name:	Lanxess Chrome Mining (Pty) Ltd
Contact person:	Mr Sarel Ferreira
Physical address:	Farm Rietfontein 338 JQ, Bleskop, Rustenburg, 0292
Telephone:	014 536 0604
Cell phone:	084 589 6599
Email:	sarel.ferreira@lanxess.com

Project Overview

Currently the only mining that is taking place is done underground with the ore crushed underground and brought to the surface on conveyor belts.

Proposed future mining activities (as set out below) will include the expansion into the neighbouring Glencore underground areas (as set out in the Introduction) as well the opening of a pit within the existing Lanxess mining right area.

Open Pit Mining

Access to the shallow resource will be by an open pit. The mining work programme indicates that there will be free digging in conjunction with open pit blasting operations. The open pit

mining sequence will start on the eastern side of the proposed pit area and progress towards the west. The final void area will be at the western extent of the open pit. Waste rock and topsoil will be stockpiled separately. Voids created will be backfilled with overburden from the progressive open pit mining, and then overlain by the various soil horizons and rehabilitated. A decline shaft to the highwall of the pit will provide future access to the existing underground sections where a short stretch of conveyor will transport the ore to the surface. The design of the highwall has been adapted to fit the topography and crown pillar position with an angle of 60°.

The ore production rate is estimated to be 40 000 tons per month (approximately 480 000 tons per annum) with a Life of Mine (LoM) of 5 years for the open pit.

Underground Mining

The underground mining method to be used will be the standard bord and pillar system. Primary extraction will be carried out by using drill rigs to drill the faces and conventional explosives. Access to the underground chrome reserves will be gained by means of surface declines that are developed from the reef outcrop.

It is calculated that the production rate will be 30 000 to 40 000 tons per month with a total LoM of 14 years.

Mineral Deposit

Lanxess produce four products namely; lumpy ore, metallurgical grade chrome ore, foundry grade chrome ore and chemical grade chrome ore.

1. Lumpy (metallurgical) ore which is sold to the ferrochrome industry where it is processed together with coal in an electric furnace to form ferrochrome.
2. Metallurgical grade chrome ore which is sold to the local ferrochrome industry where it is processed together with coal in an electric furnace to form ferrochrome.
3. Foundry grade chrome ore which is used for the manufacture of casting moulds in foundries. The same material is also used in the production of refractory materials.
4. Chemical grade chrome ore which is the raw material for the production of sodium dichromate processed by Lanxess in their other operations (chemical plants), which is the main constituent of all chrome chemicals.

Processing

The Mine's processing plant treats LG6 ore to produce the four chrome products by means of Heavy Medium Separation (HMS) in the HMS Plant and Gravity Concentration in the Gravity and Pilot Plants. This processing plant will remain in operation and will not be impacted by the proposed activities.

All products are sold to external clients. Chemical grade is also sold to other Lanxess business sites for the production of chrome chemicals.

Infrastructure

The following associated surface infrastructure will be constructed in support of the additional mining activities proposed for the site.

- Decline shaft and conveyor;
- Haul roads and service road;
- Waste rock dump;
- Topsoil stockpile; and
- A small workshop.

Purpose of this Report

Lanxess currently has an approved EIA/EMP in line with the MPRDA, and would therefore need to amend the existing approved EIA/EMP (this document) to include the details of the proposed open pit mining operations as well as the extension of the underground sections (Segment 1, 2, 3 and 4) as part of a Section 102 amendment under the MPRDA. Furthermore, this application also seeks approval for the construction of additional haul roads to service the proposed open pit mining operations.

Environmental Consultant

The details for the environmental consultant dealing with this application are set out in Table II below.

Table II: Details of environmental consultant

Company name:	Digby Wells Environmental
Contact person:	Ms Stephanie Aken
Physical address:	Digby Wells House, Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191
Telephone:	011 789 9495
Cell phone:	082 668 8430
Email:	stephanie.aken@digbywells.co.za

Approach and Methodology for the Public Participation Process

A Public Participation Process (PPP) has been initiated, which is central to the investigation of environmental and social impacts, as it is important that stakeholders who are affected by the project are given an opportunity to identify concerns and to ensure that local knowledge, needs and values are understood and taken into consideration as part of the EIA/EMP amendment process. The Identification of Interested and Affected Parties (I&APs) relating to the project was undertaken by means of the following:

- Conducting Windeed searches;

- Telephonic consultation with stakeholders in order to identify additional stakeholders and to verify existing information;
- Use of existing stakeholder databases; and
- Responses to newspaper advertisement and site notices.

Stakeholders are grouped into the following categories:

- Government: National, Provincial, District, Local authorities;
- Landowners: Directly affected and adjacent landowners;
- Land occupiers and land claimants: Directly affected and adjacent (including tribal authorities);
- Ward councillor for the area; and
- Non-Government Organisations (NGOs) and Business.

Consultation with I&APs

The aforementioned stakeholders have been informed about the proposed project by means of a formal Background Information Document (BID) containing a Registration and Comment Form as well as by an Announcement Letter which was sent by email. Details and motivation for the project were provided in the BID, which also included details about Lanxess' intention to amend their existing Mine Works Programme as well as their EMP.

An advertisement was placed in the Rustenburg Herald newspaper and site notices were put up around the proposed expansion site and in the following public places:

- Rustenburg Local Municipal Public Library;
- Bojanala District Municipality Public Library; and
- Marikana Community Library.

The BID, newspaper advertisement and site notices provided details of the proposed project, location of the expansion site, the legislative requirements, the competent authority, details of the EAP and the relevant information enabling stakeholders to become involved in the PPP. Stakeholders were encouraged to register as I&APs and to submit comments or concerns about the proposed project, using the Registration and Comment Form provided.

Project Alternatives

No property alternatives have been considered as the envisaged mining operations will occur on properties already utilised for the mining operations or on properties that The Mine currently own.

No alternatives to the mining of chrome have been considered as this application deals with the expansion of the current chrome mining operation.

The site layout in terms of the position of the haul and service roads, waste rock dump and topsoil stockpile was determined by considering both spatial and practical mining operation

aspects. As such, various options would have been considered during the planning phase in order to derive an optimal layout.

The “no-go” option for implementing the activity has been considered, but due to the fact that the mining of the remaining resources will lead to job creation and continued contribution to the GDP of not only the municipality, but also the Province as a whole, this option will not be pursued.

Conclusions and Recommendations

The Mine has a reputation for being a supplier of high quality chrome ore to various businesses as set out above.

The continuation of the Mine to produce and supply the various grades of chrome ore to a wide spectrum of industrial and commercial establishments will benefit both the local and provincial Gross Domestic Product (GDP).

As stated in the MPRDA, the Government’s objective is to maximise the benefit of the nation’s mineral resources for the benefit of all South Africans. By continuing producing chrome ore by way of expanding Lanxess’s mining operations, this objective can be accomplished, particularly through job creation.

The findings of the specialist studies and the environmental impact assessment indicates that the risks associated with the more significant impacts identified can be reduced by the proper implementation of mitigation measures and, most importantly, stringent monitoring procedures. The impact of the potential increase in dust fallout for the neighbouring properties, as well as the national highway, needs to be monitored for the LOM. Secondly the potential cumulative effects that the expansion of mining may have on the quality and quantity of both surface and groundwater in this industrial area will also need to be monitored on a regular basis.

Finally, considering the fact that the impact assessments conducted as part of the envisaged expansion works has illustrated that there are no significant environmental impacts associated with the proposed expansions (with the proviso that mitigation measures are complied with), it is the recommendation of the EAP that this Section 102 amendment be approved by the DMR.

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LIST OF ACRONYMS

AMCU	Association of Mineworkers and Construction Union
BID	Background Information Document
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)
COSATU	Congress of South African Trade Unions
DEA	National Department of Environmental Affairs
Digby Wells	Digby Wells Environmental
EAP	Environmental Assessment Practitioner
ECA	Environmental Conservation Act, 1989 (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EMS	Environmental Management System
ESA	Early Stone Age
ESIA	Environmental and Social Impact Assessment
GDP	Gross Domestic Product

GOSA	Glencore Operations South Africa (Pty) Ltd
HMS	Heavy Medium Separation
I&AP	Interested and Affected Party
IWWMP	Integrated Water and Waste Management Plan
Lanxess	Lanxess Mining (Pty) Ltd
LHD	Load-Haul-Dump
LoM	Life of Mine
LSA	Later Stone Age
MAE	Mean Annual Evaporation
mamsl	meters above mean sea level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mbgs	Metres below ground surface
mcm	million cubic meters
MHSA	Mine Health and Safety Act, 1996 (Act No. 29 of 1996)
MPRDA	Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MSA	Middle Stone Age
NEM: AQA	National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEM: BA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFA	National Forests Act, 1998 (Act No. 84 of 1998)
NGO	Non-Government Organisation
NHRA	The National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O/P	Open Pit

PCD	Pollution Control Dam
PGM	Platinum Group Metal
PPP	Public Participation Process
RLM	Rustenburg Local Municipality
ROM	Run of Mine
SANCO	South African National Civic Organisation
SSC	Species of Special Concern
The Mine	Lanxess Chrome Mine
TSF	Tailings Storage Facility
U/G	Under Ground
WBPA	Waterberg Bojanala Priority Area
WMA	Water Management Area
WUL	Water Use Licence

Part A: Scope of Assessment and Environmental Impact Assessment Report

1 Introduction

Lanxess Chrome Mine (the Mine or LCM) is a well-established chrome mine in the Rustenburg area which has been operational since 1958. Currently only the underground mining of chrome is taking place at the site. Chromite ore is used in the ferrochrome industry as well as the production of chrome chemicals where the primary use is as leather tanning agents.

Lanxess Chrome Mining (Pty) Ltd (Lanxess) has proposed an amendment to its mine plan by extending the existing underground chrome operations into neighbouring properties as well as the establishment of an open pit mine within its existing mining right area.

The proposed project will be required to comply with the provisions of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and the Environmental Impact Assessment Regulations, 2014, (GN R982 of 4 December 2014) promulgated in terms of Sections 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

Lanxess currently has an approved Environmental Impact Assessment and Environmental Management Plan (EIA/EMP) in line with the MPRDA that cover various portions of the farms Kroondal 304 JQ, Rietfontein 338 JQ and Klipfontein 300 JQ and would therefore need to amend the existing EIA/EMP to include the details of the proposed open pit mining operations on the farm Rietfontein 338 JQ (owned by the mine) as well as the extension of the underground sections (Segment 1, 2, 3 and 4) on portions of the farms Kroondal 304 JQ, Klipfontein 300 JQ and Brakspruit 299 JQ. The substantial changes to the existing mining areas also requires a Section 11 transfer in terms of the MPRDA to cede the Mining Rights held over the 4 segments by Glencore Operations South Africa (Pty) Ltd (GOSA) to Lanxess. The Section 102 Amendment will include the expansion of the underground operations into the following four segments:

- Segment 1 (Kroondal area);
- Segment 2 (Amplats Operational Area (AOA));
- Segment 3 (AOA); and
- Segment 4 (Wonderkop area).

The consent of the Minister of Mineral Resources (DMR) to effect these amendments will be sought in terms of the provisions Section 102 amendment under the MPRDA. At the same time, the consent of the Minister to amend the mining work programme as well as the Social and Labour Plan to deal with the amendments to the mine plan will be sought. This Report does not however deal with amendment of the mining work programme or Social and Labour plan.

The purpose of this Report is to described and assess the environmental impacts of the proposed mine extensions only; it does not deal with the existing, authorised mining activities. However, for the purposes of holistic site management and ease of auditing, the

EMP will be presented as a consolidated document and incorporate where relevant elements of the existing approved EIA/EMP.

An amendment to the existing Integrated Water Use License Application (IWULA) and Integrated Water and Waste Management Plan (IWWMP), submitted to the then Department of Water Affairs, now Department of Water and Sanitation (DWS), will also be required.

2 Item 3: Project Applicant

The Mine has a reputation as being a supplier of high quality chrome ore. The Mine is run by Lanxess' Leather business unit and supplies in particular company sites in South Africa and Argentina that process the raw material into chrome chemical intermediates and finally into products for, amongst others, the manufacture of leather. It is situated approximately 14 km from the town of Rustenburg in the North West Province. The mine is part of a mineral deposit known as the Bushveld Igneous Complex which holds the majority of South Africa's chrome ore deposits.

The ore is crushed underground and brought to the surface by a system of conveyor belts. On surface it is processed to yield chemical concentrate, the raw material for Lanxess' chrome chemicals plants, lumpy ore and metallurgical concentrate the raw material for the ferrochrome industry, as well as foundry sands which is used in metal foundries.

2.1 Item 3(a)(i): Details of the EAP

Digby Wells Environmental (Digby Wells) is a South African company with international expertise in providing Environmental and Social services to South African and International clients, with the focus predominantly on the Mineral Resources and Energy sectors in Africa. Please refer to Table 2-1 below for the contact details of the EAP.

Table 2-1: Contact details of the EAP

Name of Practitioner:	Ms Stephanie Aken
Telephone:	011 789 9495
Fax:	011 789 9498
Email:	stephanie.aken@digbywells.com

2.2 Item 3(a)(ii): Expertise of the EAP

2.2.1 Qualifications of the EAP

Ms Aken holds the following degrees/diplomas (please refer to Appendix A):

- BSc Zoology and Entomology, Rhodes University, 2003;
- BSc Hons, Rhodes University, 2004; and
- Post-grad diploma in Environmental Science, Wits University, 2014.

2.2.2 Summary of EAP's past Experience

Ms Aken has eight years' experience as an Environmental Consultant and has participated in various projects for different commodities. Her involvement has ranged from project manager to undertaking various specialist studies, including public consultation, from initiation to the final authorisation of projects. She has gained experience on IFC and World Bank projects as well as dealing with local legislation in South Africa and other African countries.

Currently she is in the Environmental and Legal Services Department at Digby Wells, which handles various environmental licencing and permitting processes in the Mining and Energy sector, which are undertaken concurrently for the life of the projects. These processes include Mining Rights, Waste and Water licences as well as Environmental and Social Impact Assessment (ESIA) authorisations.

Ms Aken was also seconded to Xstrata Coal for 12 months to assist the Environmental Manager in the legal permitting and auditing processes as well as managing the consultants on their greenfield projects.

3 Item 3(b): Description of the Property

The process will involve the authorisation of the proposed open pit mining operation on the farm Rietfontein 338 JQ (owned by the Mine) and the proposed underground mining operations on portions of the farms Kroondal 304 JQ, Klipfontein 300 JQ and Brakspruit 299 JQ. Glencore Operations South Africa (Pty) Ltd (formerly known as Xstrata) currently holds the mining rights for some of these areas which are currently in the legal process of being transferred to Lanxess.

As part of an agreement between Glencore Operations South Africa (Pty) Ltd (GOSA) and Lanxess, GOSA intends to transfer certain of its Mining Rights or portions of its rights to Lanxess, with Lanxess transferring a certain portion of its converted Mining Right to Glencore. The transfer agreement between GOSA and Lanxess will entail the transfer of the following areas to Lanxess:

- A portion of the Kroondal 273 Mining Right Area (Segment 1);
- Two portions of the AOA Prospecting Right Area (Segment 2 and 3) (GOSA is currently undertaking the process of converting the Prospecting Right to a Mining Right for these segments); and
- The Wonderkop Mining Right Area (Segment 4).

Please refer to Table 3-1 for a full list of properties.

Table 3-1: Property descriptions

Farm Name(s) and 21 digit Surveyor General Code for each farm portion:	Portion 95 of Kroondal 304 JQ	T0JQ00000000030400095
	Portion 96 of Kroondal 304 JQ	T0JQ00000000030400096
	Portion 97 of Kroondal 304 JQ	T0JQ00000000030400097
	Portion 98 of Kroondal 304 JQ	T0JQ00000000030400098
	Remainder Portion of Klipfontein 300 JQ	T0JQ00000000030000000
	Portion 1 of Rietfontein 338 JQ	T0JQ00000000033800001
	Portion 10 of Rietfontein 338 JQ	T0JQ00000000033800010
	Portion 11 of Rietfontein 338 JQ	T0JQ00000000033800011
	Portion 14 of Rietfontein 338 JQ	T0JQ00000000033800014
	Portion 32 of Rietfontein 338 JQ	T0JQ00000000033800032
	Portion 34 of Rietfontein 338 JQ	T0JQ00000000033800034
	Remainder Portion 1 of Rietfontein 338 JQ	T0JQ00000000033800001
	Portion 1 of Spruitfontein 341 JQ	T0JQ00000000034100001
	Remainder Portion of portion 12 of Brakspruit 299 JQ	T0JQ00000000029900012
	Portion 17 of Brakspruit 299 JQ	T0JQ00000000029900017
	Portion 18 of Brakspruit 299 JQ	T0JQ00000000029900018
	Portion 19 of Brakspruit 299 JQ	T0JQ00000000029900019
	Remainder Portion 19 of Brakspruit 299 JQ	T0JQ0000000002990001
Application Area (Ha):	130.79 ha	
Magisterial District:	Rustenburg Local Municipality (RLM)	
Distance and direction from nearest town:	7 km East of Kroondal and 11 km south-east of Rustenburg.	

4 Item 3(c) of Appendix 3: Locality Map

Please refer to the Regional Setting map (1:150 000) as well as the Local Setting map (1:40 000) attached as Appendix 3 (see Plans 1 and 2 respectively).

5 Item 3(d) of Appendix 3: Description of the Scope of the Proposed Overall Activity

Please refer to the Proposed Open Pit Infrastructure Map (1: 22 000) attached as Appendix 3 (see Plans 3 a and 3 b).

Currently the only mining that is taking place is done underground with the ore crushed underground and brought to the surface on conveyor belts.

Proposed future mining activities will include the expansion into the neighbouring Glencore underground areas as well the opening of a pit within the existing Lanxess mining right area, as set out below.

Open Pit Mining

Access to the shallow resource will be by an open pit cut 1 374 m in strike length and down to a vertical depth between 50 m and 70 m below surface. The programme indicates that there will be free digging up to ±14 metres below ground surface (mbgs) where after open pit blasting operations will take over, mining 100 m x 300 m block sizes at 10 m cuts, utilising the Load-Haul-Dump, or LHD method, with excavators and dump trucks. The open pit mining sequence will start on the eastern side of the proposed pit area and progress towards the west. The final void area will be at the western extent of the open pit. Waste rock and topsoil will be stockpiled separately to the south of the open pit area. As the open pit mining progresses, the voids created will be backfilled with overburden from the progressive open pit mining, and then overlain by the various soil horizons and rehabilitated. The design of the highwall has been adapted to fit the topography and crown pillar position with an angle of 60°.

The ore production rate is estimated to be 40 000 tons per month (approximately 480 000 tons per annum) with a Life of Mine (LoM) of 5 years for the open pit.

Underground Mining

The underground mining method to be used will be the standard bord and pillar system. The pillar dimensions and bord widths are such that a safety factor of 1.6 is maintained. Primary extraction will be carried out by using drill rigs to drill the faces and conventional explosives. Access to the underground chrome reserves will be gained by means of surface declines that are developed from the reef outcrop. Run of Mine clearance is facilitated by a series of conveyor belts fed by underground LHD loaders.

It is calculated that the production rate will be 30 000 to 40 000 tons per month with a total LoM of 14 years.

Mineral Deposit

Lanxess produce four products namely; lumpy ore, metallurgical grade chrome ore, foundry grade chrome ore and chemical grade chrome ore.

1. Lumpy (metallurgical) ore with typically 38 – 41% Cr_2O_3 and a specified size distribution is sold to the ferrochrome industry where it is processed together with coal in an electric furnace to form ferrochrome. Ferrochrome is the master alloy used in the production of a wide range of corrosion and heat resistant stainless steel.

2. Metallurgical grade chrome ore with 44% chrome is sold to the local ferrochrome industry where it is processed together with coal in an electric furnace to form ferrochrome.
3. Foundry grade chrome ore with a Cr_2O_3 content of typically 46.5% and a strictly specified grain size distribution is used for the manufacture of casting moulds in foundries. The same material is also used in the production of refractory materials.
4. Chemical grade chrome ore with a typical Cr_2O_3 content of 46.0% is the raw material for the production of sodium dichromate processed by Lanxess in their other operations (chemical plants), which is the main constituent of all chrome chemicals. Chrome chemicals are used for example as leather tanning agents.

Processing

The Mine's processing plant treats LG6 ore to produce the four chrome products by means of Heavy Medium Separation (HMS) in the HMS Plant and Gravity Concentration in the Gravity and Pilot Plants. The HMS plant has a capacity of 3 600 tons per day and the gravity plant has a capacity of 1 800 tons per day. This processing plant will remain in operation and will not be impacted by the proposed activities. The processing activities are summarised in Figure 5-1.

All products are sold to external clients. Chemical grade is also sold to other Lanxess business sites for the production of chrome chemicals.

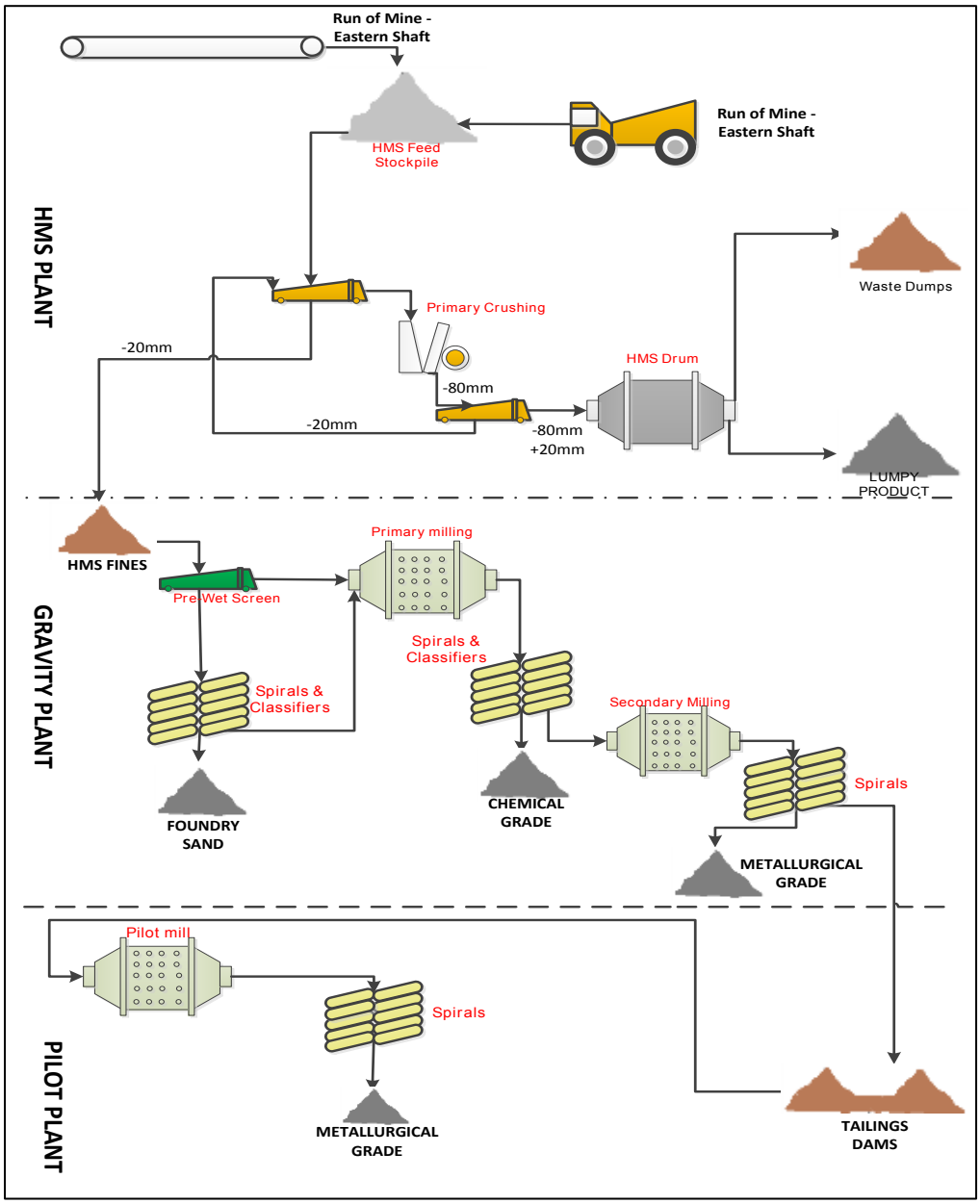

Figure 5-1: Schematic of processing at the Mine

5.1 Item 3(d)(i): Listed and Specified Activities

Please refer to Table 5-1 for listed and specified activities.

Table 5-1: Listed and specified activities

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
The transportation of construction material to the Project site via national, provincial and local roads.	Undefined – Temporary activity	-	NOT LISTED

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
Storage of fuel, lubricant and explosives in temporary facilities for the duration of the construction phase.	500 m^2 – Temporary activity	-	NOT LISTED
Site clearance and topsoil removal prior to the commencement of physical construction activities across the project area.	167.1891 ha (Open pit Area only) – includes all open pit infrastructure (pit, waste rock dump, topsoil dump, offices, workshop, parking and roads)	-	NOT LISTED
The construction of waste rock dumps.	100.17 ha	-	NOT LISTED
The construction of topsoil stockpiles.	10.87 ha	-	NOT LISTED
The establishment of the initial boxcut and access ramps to the open-pit mining areas.	30 000 m^2	-	NOT LISTED
The establishment of underground access shaft.	100 m^2	-	NOT LISTED
The development of a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres (haul roads)	13 ha	X	GN R. 983, Activity 24
The construction of the hard park area (this is made up of the workshop, office block and parking lot).	0.98 ha	-	NOT LISTED
Drilling and blasting of the overburden rock for easy removal by excavators and dump trucks.	N/A	-	NOT LISTED
Dumping of waste rock and maintenance of waste rock dump.	N/A	-	NOT LISTED
Removal and loading of ore onto trucks (O/P) or conveyor (U/G) to the plant.	N/A	-	NOT LISTED
Continuing operation of existing processing plant (Crusher, settler, gravity plant and reclamation plant).	2 500 m^2	-	NOT LISTED

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
Storage of fuel in diesel tanks, as well as lubricant and explosives in facilities for the duration of the Project.	400 m^2	-	NOT LISTED
Vehicular activity on the proposed roads and maintenance activities.	N/A	-	NOT LISTED
The operation of the Tailings Storage Facility (TSF) (dirty water from stormwater and dewatering mining activities) and the connected return water dam.	17.9 ha	-	NOT LISTED
Continuing operation and maintenance of the stockpiles, including topsoil and ROM stockpiles.	N/A	-	NOT LISTED
Waste and sewage generation and disposal.	N/A	-	NOT LISTED
Maintenance of secondary infrastructure (offices, parking).	N/A	-	NOT LISTED
Concurrent replacement of overburden and topsoil and the re-vegetation of mined out strips. The mined strip will be backfilled with the overburden and compacted. Subsequently, the topsoil will be placed on top of the overburden and the area will be vegetated.	N/A	-	NOT LISTED
Removal of surface infrastructure (Plant machinery, shafts, conveyors).	N/A	-	NOT LISTED
Decommissioning of services (if necessary, depending on post land use) incl. waste treatment and removal, power & water facilities).	N/A	-	NOT LISTED
Rehabilitation of roads and cleared areas (offices and workshop area).	N/A	-	NOT LISTED
Removal of fuel, lubricant and explosives.	N/A	-	NOT LISTED
Safe closure of shafts and mine access ramps.	N/A	-	NOT LISTED
Final replacement of overburden and topsoil and the establishment of vegetation on the final open cast void. Overburden will be backfilled into the final void and compacted. Subsequently, topsoil will placed and the	N/A	-	NOT LISTED

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
area vegetated.			
Waste handling of scrap metal and used oil as a result of the Decommissioning Phase will be undertaken.	N/A	-	NOT LISTED
Post-closure monitoring and rehabilitation will determine the level of success of the rehabilitation, as well as to identify any additional measures that have to be undertaken to ensure that the mining area is restored to an adequate state. Monitoring will include surface water, groundwater, soil fertility and erosion, natural vegetation and alien invasive species and dust generation from the discard dumps.	N/A	-	NOT LISTED

5.2 Item 3(d)(ii): Description of the Activities to be Undertaken

5.2.1 Open Pit Mining

As discussed in Section 5 above, access to the shallow resource on the farm Rietfontein 338 JQ (which falls within the current mining right area) will be by an open pit cut 1 374 m in strike length and down to a vertical depth up to 70 m below surface. The programme indicates that there will be free digging, followed by open pit blasting operations that will take place in 100 m x 300 m block sizes at 10 m cuts (utilising the LHD method, with excavators and dump trucks). The open pit mining sequence will move from east to west. The final void area will be at the western extent of the open pit. Waste rock and topsoil will be stockpiled separately and as the open pit mining progresses, the voids created will be backfilled with overburden from the progressive open pit mining, and then overlain by the various soil horizons and rehabilitated.

The proposed surface infrastructure (haul roads, waste rock stockpile, topsoil stockpile, offices) will be located on the farm Rietfontein.

A decline shaft to the highwall of the pit will provide future access to the existing underground sections where a short stretch of conveyor will transport the ore to the surface.

5.2.2 Underground Mining

The underground mining method used will be the standard bord and pillar system. Primary extraction is carried out by using drill rigs to drill the faces and conventional explosives. Access to the underground chrome reserves is gained by means of surface declines developed from the reef outcrop. Run of Mine clearance is facilitated by a series of conveyor belts fed by underground LHD loaders.

As set out in the Introduction to this report, the proposed underground mining operations on portions of the farms Kroondal 304 JQ, Klipfontein 300 JQ and Brakspruit 299 JQ. GOSA currently holds the mining rights for some of these areas which are currently in the legal process of being transferred to Lanxess by means of a Section 11 application. The transfer agreement between GOSA and Lanxess will entail the transfer of the following areas to Lanxess:

- A portion of the Kroondal 273 Mining Right Area (Segment 1);
- Two portions of the AOA Prospecting Right Area (Segment 2 and 3) (GOSA is currently undertaking the process of converting the Prospecting Right to a Mining Right for these segments); and
- The Wonderkop Mining Right Area (Segment 4).

5.2.2.1 Segment 1

Lanxess proposes to acquire the right to mine on Segment 1. The mining right (275) for segment 1 is currently held by a JV of Glencore and Samancor. A Section 11 transfer to cede the Mining Rights from GOSA to Lanxess is currently being undertaken in terms of the MPRDA. The portions that form part of Segment 1 on the Farm Kroondal 304 JQ are listed below:

- The Remaining Extent of mineral area 11 (a portion of portion 95);
- The Remaining Extent of Mineral area 12 (a Portion of Portion 97); and
- The Remaining Extent of Mineral area 14 (a portion of portion 96).

A portion of a TSF, understood to belong to Aquarius, is situated on the northern section of Segment 1. Lanxess proposes to undertake underground mining activities in Segment 1 in 2017.

The original EMPR for the Kroondal Mine was approved in 2003. Since then, various Section 102 EMP Amendment reports were compiled to include additional activities on the Kroondal Mine.

No surface related infrastructure will be constructed on Segment 1 and access to underground workings will be gained using existing infrastructure on Lanxess current Mining Right area.

5.2.2.2 Segments 2 and 3

Lanxess proposes to extend their current underground mining activities in a northerly direction towards Segment 2 and Segment 3 on the Farm Klipfontein 300 JQ as part of the Section 102 Amendment (refer to Appendix 3, Plan 2 depicting the location of Segment 2 and Segment 3). On succession of the Section 11 transfer and approval of the Section 102 Amendment by the Minister of the DMR, underground mining activities are anticipated to commence in 2017 for Segment 2 and 2020 for Segment 3. The portions that form part of Segment 2 and Segment 3 on the Farm Klipfontein 300 JQ are listed below:

- Portion 4;
- Portion 5; and
- Remaining Extent of Portion 2.

A TSF is present in the eastern section of Segment 2 and the western section of Segment 3. Mining infrastructure is also present in the eastern section of Segment 3. It is understood that the TSF is owned and operated by Anglo Platinum.

No surface related infrastructure will be constructed on Segment 2 or 3 and access to underground workings will be gained using existing infrastructure on Lanxess current Mining Right area.

5.2.2.3 Segment 4

Lanxess proposes to extend their current underground mining activities eastward into Segment 4 (the Wonderkop area). Mining activities have been undertaken in the south corner of the Wonderkop area. The Wonderkop Mine historically supplied ore material to the Wonderkop Smelter which commenced production during 1996. The Smelter Operations developed since and consists of six Furnaces, two Metal Extraction Plants, a Pelletizing Plants and other related infrastructure. GOSA currently holds a converted mining right (NW 30/5/1/2/2/274 MR) to mine chrome over Portion 1 of the farm Spruitfontein 341 JQ and the Remaining Portion, Remaining Portion of Portion 12, Portions 17, 18 and 19 (Portions of Portion 12) all of the Farm Brakspruit 299 JQ.GOSA will apply in terms of Section 11 of the MPRDA to the Minister for consent to transfer the whole Wonderkop Mining Right from GOSA to Lanxess.

No surface related infrastructure will be constructed on Segment 1 and access to underground workings will be gained using existing infrastructure on Lanxess current Mining Right area.

5.2.3 Production Rate

The reef tonnage will be 25 000 tons/month at full production per opencast with average overburden rock volumes of 55 000 m^3/month. A breakdown of the production rates are given in Table 5-2.

Table 5-2: Breakdown of production rates

List of Product	Tons/year	Proportionate Quantities of total
Lumpy	324 kt	27%
Foundry sand	120 kt	10%
Chemical Grade	384 kt	32%
Metallurgical Concentrate	372 kt	31%

List of Product	Tons/year	Proportionate Quantities of total
Total	**1 200 kt**	**100**

5.2.4 Existing Infrastructure

Existing infrastructure on the mine is set out in Table 5-3.

Table 5-3: Existing infrastructure

Infrastructure	Associated Activities
Incline and Shafts (vertical and ventilation)	Provide access to the underground workings.
Underground workings	Drilling and blasting. Loading and transfer of ore to conveyors. Conveyor belt transport ore to plant.
Processing facilities ■ Crusher ■ Settlers ■ HMS (Heavy Medium Separator) ■ Gravity plant ■ New reclamation plant	Beneficiation. Crushing and screening. HMS Plant: The coarse fraction >19mm is fed into a heavy media separation plant in order to separate the remaining waste from lumpy ore which is then sold as lumpy ore into the ferrochrome industry. Gravity Plant: The fine fraction of ROM (<19mm) is upgraded to foundry sand (CO4) and chemical grade (CO1) by milling, screening spiralling and hydro-classification. Regrinding of the waste material leaving from the foundry sands and chemical grade circuits and subsequently re-classification, results in the metallurgical grade products (CO6) Plant for the reclamation of 12 year old tailings dam.
Waste rock dumps	Dumping of waste rock.
Stockpiles: ■ ROM ■ Lumpy Ore ■ Crusher Fines ■ HMS Fines ■ CO1	Stockpiling of material before use or transport. (Bunded).

Infrastructure	Associated Activities
■ CO4 ■ CO6	
Tailings dams	Tailings material from processing is pumped by pipeline to the tailings dam. Tailings deposition. Waste management facility.
Transport infrastructure ■ Conveyor belt ■ Roads	Load-Haul-Dump vehicles transport broken ore to the nearest conveyor belt loading point. Ore is then transported to a central point on surface by a network of conveyor systems, with a total length of more than 18 km, where it is dumped on the run of mine stockpile. Earthworks. Transport of material (road to siding for further transport via rail).
Water management facilities ■ Sewage treatment ■ Settling ponds ■ Return water dams ■ Boreholes	Treatment of sewage generated on the site (hostels, villages, change rooms etc.). Chemicals are used at sewage treatment plant. Spillages (solids) are picked up and suspended with water to be transferred to the settling ponds. A flocculant is used to produce sludge to be transferred to the tailings dam. A cyclone is used to remove ultra-fine chrome. Return water dams to manage water from tailings dam and recycle.
Support infrastructure ■ Stores (including magazines) ■ Workshops ■ Offices ■ Power lines ■ Access roads	Storage of materials, equipment and explosives. Maintenance. Administration and management.
Housing	The majority of the mine's employees do not live on the mine property. Lower skilled employees live in a small village.

5.2.5 Proposed New Surface Infrastructure

The following associated surface infrastructure will be constructed in support of the additional mining activities proposed for the site.

- Decline shaft and conveyor – A decline shaft will be constructed on the western side of the pit to access underground areas through the highwall. An additional section of conveyor will be needed to transport ore from the underground and up to the surface.
- Haul roads and service road – Approximately 5 km of haul roads, 25 m wide to accommodate two lanes of traffic. The haul roads connect the existing road network with the open pit as well as the stockpile areas.

  A service or access road will be constructed to provide access to open pit operation from the southern boundary of the site. These roads will most likely be gravel and 8m wide.
- Dump – An additional waste rock or overburden dump will be required alongside the open pit for overburden removed during mining. This proposed dump will have a footprint of approximately 100 ha and a height of 30 m.
- Stockpile – An additional topsoil stockpile will be located between the waste rock dump and the N4 highway. This will be screened off by trees. This proposed stockpile will measure have a footprint of approximately 11 ha and a height of 25 m.
- A small workshop, office block and parking area will be built in the area of the open pit (less than 1ha).

6 Item 3(e): Policy and Legislative Context

Please refer to Table 6-1 for a summary of the applicable policies and legislation pertaining to this application.

Table 6-1: Relevant policies and legislation

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
The Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)	Part A: Sections 1 through 23 and Part B: Sections 1 through 12	This Section 102 Amendment document has been compiled in accordance with the Act.
The National Environmental Management Act, 1998 (Act No. 107 of 1998)	Part A: Section 5.1	Listed activities as per the NEMA Regulations had been considered, no application for authorisation for NEMA listed activities had been applied for.
National Environmental	Part A: Section 5.1	Listed activities as per the NEM:

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Management: Waste Act, 2008 (Act No. 59 of 2008).		WA Regulations had been considered, no application for a waste licence had been applied for.
The National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Part A: Section 8.4 and 22.2	The heritage assessment was undertaken in accordance with the NHRA.
National Environment Management: Air Quality Act (Act No. 39 of 2004)	Part A: Section 8.4 and 22.2	The Air Quality Assessment was conducted in accordance with the NEM: AQA.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)	Part A: Section 8.4 and 22.2	The Fauna & Flora study considered CARA in terms of alien invasive species found on site.
National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)	Part A: Section 8.4 and 22.2	The Fauna & Flora study considered NEM: BA in terms of sensitive species possibly found on site.
National Forests Act, 1998 (Act No. 84 of 1998)	Part A: Section 8.4 and 22.2	The Fauna & Flora study considered NFA in terms of sensitive tree species possibly found on site.
Environmental Conservation Act, 1989 (Act No. 73 of 1989) and SANS 10103:2008	Part A: Section 8.4 and 22.2	Legislation and standards adhered to as part of the noise study.

7 Item 3(f): Need and Desirability of the Proposed Activities

The Mine has a reputation for being a supplier of high quality chrome ore to various businesses. Lumpy (metallurgical ore) is sold the ferrochrome industry where it is processed with coal in an electric furnace to form ferrochrome, which, in turn, is the master alloy used in the production of a wide range of corrosion and heat resistant stainless steel. Foundry grade chrome ore is used for the manufacture of casting moulds in foundries. The same material is also used in the production of refractory materials. And finally, chemical grade chrome ore is the raw material for the production of sodium dichromate processed by Lanxess in their other operations (chemical plants), which is the main constituent of all chrome chemicals. Chrome chemicals are used, for example, as leather tanning agents.

The continuation of the Mine to produce and supply the various grades of chrome ore to a wide spectrum of industrial and commercial establishments will benefit the Gross Domestic Product (GDP) of not only the municipality, but also the Province as a whole.

Finally, as stated in the MPRDA, the Government's objective is to maximise the benefit of the nation's mineral resources for the benefit of all South Africans. By continuing producing chrome ore by way of expanding Lanxess's mining operations, this objective can be accomplished through, amongst other activities, job creation.

8 Item 3(g): Motivation for the Preferred Development Footprint within the Approved Site including a full Description of the process followed to reach the Proposed Development Footprint within the Approved Site

Lanxess already has an approved EIA/EMP in line with the MPRDA for its current operations and envisages expanding its operations both within its approved mining right area and partially onto the neighbouring farm Rietfontein 338 JQ, which Lanxess owns. Therefore the site layout in terms of the position of the haul and service roads, waste rock dump and topsoil stockpile was determined by considering both spatial and practical mining operation aspects, and not environmental aspects as such, due to the fact that it is an already disturbed area.

Please refer to Sections 3 and 5 for relevant details around the envisaged mining expansions.

8.1 Item 3(g)(i): Details of the Development Footprint Alternatives Considered

With reference to the site plan provided as Appendix 4 (see Plans 3 a and 3 b), which indicates the location of the individual activities on site, the alternatives that were considered with respect to the type of activity, design of the activity, the technology to be used in the activity, the operational aspects of the activity and the "No-go" option are set out below.

8.1.1 The Property on which or Location where it is Proposed to Undertake the Activity

8.1.1.1 Existing Ownership

As LCM envisages expanding current mining operations, alternatives considered in terms of properties on which mining activities is to take place were limited as the envisaged activities will take place on properties already utilised for mining operations, and for which Lanxess holds the mining rights. The proposed open pit area is proposed for the south eastern portion of LCM's existing mining right area, the extension of the underground areas (Amplats, Kroondal and Wonderkop) will be incorporated into the existing mining right area

via the Section 11 transfer process and a new topsoil and waste rock dump will be developed on the farm Rietfontein 338 JQ, which is owned by Lanxess.

However, some options have been considered in terms of the placement of specific infrastructure within Lanxess's mining rights area and/or properties currently owned by Lanxess. These options are discussed below.

8.1.1.2 Location of Open Pit

As the positioning of the open pit area was driven by the location of the chrome reserve, no alternatives in terms of the location of the pit were considered.

8.1.1.3 Location of Waste Rock Dump and Soil Stockpile

The alternative of utilising the existing waste rock dump for the deposition of the waste rock emanating from the open pit development was considered. This is not the preferred option as the current waste rock dump is reaching capacity, in conjunction with the fact that no space is available for the dump on the existing mining area.

A second alternative to the placement of the waste rock dump was also considered. This entailed depositing the waste rock to the north of the pit. This was also not a preferred option as the fauna and flora studies noted that the area to the North were seen to be in a more natural state than the area to the south, the preferred option.

The preferred option involves the new waste rock dump being developed on a portion of the farm Rietfontein 338 JQ, south of the pit area, which Lanxess owns. This is the preferred alternative as the site is seen to be heavily disturbed by past agricultural practices.

Similarly, the location of the new top soil stockpile is also envisaged for the farm Rietfontein 338 JQ as there is limited space on the existing operational area.

8.1.2 The Type of Activity to be Undertaken

8.1.2.1 Mining Method Alternatives

The preferred mining methods relating to this application includes both open pit and bord and pillar mining activities for the new segments. An alternative to bord and pillar mining that was considered involves total extraction, however, due to the risks and environmental impacts associated with this method, the foremost risk being subsidence, this option was not pursued.

8.1.2.2 Land Use Alternatives

Although agriculture could be considered as an economically viable land use alternative, agricultural activities would not provide the level of medium term economic growth in comparison to the mining activities, which is the preferred alternative.

8.1.3 The Design or Layout of the Activity

The site layout in terms of the position of the haul and service roads, waste rock dump and topsoil stockpile was determined by considering both spatial and practical mining operation aspects. Furthermore, environmentally sensitive areas were also taken into consideration during the design phase to the extent that they are avoided. Therefore various options would have been considered during the planning phase in order to derive an optimal layout.

8.1.4 The Technology to be used in the Activity

In terms of processing, the existing plant will still be used and thus no other alternatives were considered.

8.1.5 The Operational Aspects of the Activity

Various options had been considered in terms of the mining sequence and scheduling during the concept phase.

8.1.6 The Option of Not Implementing the Activity

The “no-go” option for implementing the activity has been considered, but due to the fact that the mining of the remaining resources will lead to job creation and continued contribution to the GDP of not only the municipality, but also the Province as a whole, this option will not be pursued.

8.2 Item 3(g)(ii): Details of the Public Participation Process Followed

A Public Participation Process (PPP), which is central to the investigation of environmental and social impacts, has been initiated. It is important that stakeholders who are affected by the project are given an opportunity to identify concerns and to ensure that local knowledge, needs and values are understood and taken into consideration as part of the EIA/EMP amendment process. The process of identifying Interested and Affected Parties (I&APs) relating to the proposed project, as well as the details of the consultation process that was undertaken, is detailed below.

8.2.1 Stakeholder Identification

To ensure a proper representation of all stakeholders, the following identification methods were used to develop a stakeholder database:

- Conducting Windeed searches;
- Telephonic consultation with stakeholders in order to identify additional stakeholders and to verify existing information;
- Use of existing stakeholder databases; and
- Responses to newspaper advertisement and site notices.

Stakeholders are grouped into the following categories:

- Government: National, Provincial, District, Local authorities;
- Landowners: Directly affected and adjacent landowners;
- Land occupiers and land claimants: Directly affected and adjacent (including tribal authorities);
- Ward councillor for the area; and
- Non-Government Organisations (NGOs) and Business.

8.2.1.1 Government

The following government bodies have been included as I&APs:

- Department of Agricultural and Rural Development;
- DMR;
- National Department of Environmental Affairs (DEA);
- North West Department of Rural Development and Land Reform;
- Rustenburg Local Municipality (RLM); and
- Bojanala District Municipality.

8.2.1.2 Businesses and Parastatals

The following business and parastatals have been included in the Stakeholder Database:

- Kroonvestment (Pty) Ltd;
- Eskom North West; and
- Telkom North West.

8.2.1.3 Community Organisations

The following community organisations have been registered as I&APs

- South African National Civic Organisation (SANCO);
- Womans League; and
- Bafokeng Tribal Authority.

8.2.1.4 Unions

Three unions have been included in the Stakeholder Database and include:

- Congress of South African Trade Unions (COSATU);
- National Union of Mine Workers South Africa (NUMSA); and
- Association of Mineworkers and Construction Union (AMCU).

8.2.1.5 Land Owners

The landowners affected by the proposed project are categorised as directly affected and adjacent landowners. These are listed in Table 8-1 and Table 8-2 below.

Table 8-1: Directly affected landowners

Farm Name	Portion	Owner
Brakspruit 299 JQ	RE	Glencore Operations South Africa
Klipfontein 300 JQ	RE	Information pending
Klipfontein 300 JQ	RE	Republic Of Bophuthatswana
Kroondal 304 JQ	RE	Deutsche Evangelisch Lutherische Gemeinde Von Kroondal
Kroondal 304 JQ	95	Private Person
Kroondal 304 JQ	97	Rudolf Ottermann Familie Trust
Kroondal 304 JQ	98	Rudolf Ottermann Familie Trust
Kroondal 304 JQ	98	Rudolf Ottermann Familie Trust
Kroondal 304 JQ	144	No information on windeed
Rietfontein 338 JQ	RE	No information on windeed
Rietfontein 338 JQ	1	Rustenburg Chrome Mine Holding (Pty) Ltd
Rietfontein 338 JQ	10	Rustenburg Platinum Mine
Rietfontein 338 JQ	11	Bayer (Pty) Ltd
Rietfontein 338 JQ	14	Bayer (Pty) Ltd
Rietfontein 338 JQ	32	Bayer (Pty) Ltd
Rietfontein 338 JQ	34	Bayer (Pty) Ltd

Table 8-2: Indirectly affected landowners

Farm Name	Portion	Owner
Brakspruit 299 JQ	RE	Glencore Operations South Africa
Brakspruit 299 JQ	10	First Platinum
Brakspruit 299 JQ	11	First Platinum
Brakspruit 299 JQ	12	Aquarius Platinum (South Africa)
Brakspruit 299 JQ	14	First Platinum
Brakspruit 299 JQ	15	First Platinum
Brakspruit 299 JQ	16	Glencore Operations South Africa
Brakspruit 299 JQ	22	Glencore Operations South Africa
Kroondal 304 JQ	94	Aquarius Platinum (South Africa)
Kroondal 304 JQ	150	Aquarius Platinum (South Africa)
Kroondal 304 JQ	151	Aquarius Platinum (South Africa)
Rietfontein 338 JQ	12	Benrens August Johannes

Farm Name	Portion	Owner
Rietfontein 338 JQ	13	AJB Trust
Rietfontein 338 JQ	28	Meyer Gretchen Walda
Rietfontein 338 JQ	RE	No information on Windeed
Rietfontein 338 JQ	30	HRF Trust
Spruitfontein 341 JQ	RE	Trojan Exploration Co (Pty) Ltd
Spruitfontein 341 JQ	16	Glencore Operations South Africa
Spruitfontein 341 JQ	101	Aquarius Platinum (South Africa)

8.2.1.6 Land Occupiers and Land Claimants

A letter was submitted to the office of Northwest Department of Rural Development and Land Reform, Land Claims Commission, on the 16th of April 2015. We are awaiting the results of this enquiry. There are no land occupiers on the site.

8.2.1.7 Ward Councillor

Cllr Motlhasedi, Ward Councillor of Kroondal, and Cllr Molefe of Ward 33, Kroondal (within the RLM) was notified of the proposed project.

All stakeholder information has been captured in an electronic database (see Appendix B), which will be updated throughout the Section 102 process.

8.2.2 Consultation with I&APs

The aforementioned stakeholders have been informed about the proposed project by means of a formal Background Information Document (BID) containing a Registration and Comment Form (Appendix C) and Announcement Letter (Appendix C) which was sent by email on Friday, 06 March 2015 to the Stakeholder Database. Details and motivation for the project were provided in the BID, which also included details about LCM's intention to amend their existing Mine Works Programme.

An advertisement was placed in the Rustenburg Herald newspaper on Friday, 13 March 2015 (see Appendix C). Site notices were put up around the proposed expansion site and in the following public places:

- RLM Public Library;
- Bojanala District Municipality Public Library; and
- Marikana Community Library.

See Appendix C for the site notice report.

The BID, newspaper advertisement and site notices provided details of the proposed project, location of the expansion site, the legislative requirements, the competent authority, details of the EAP and the relevant information enabling stakeholders to become involved in the

PPP. Stakeholders were encouraged to register as I&APs and to submit comments or concerns about the proposed project, using the Registration and Comment Form provided.

The Draft Section 102 Report will be made available for public comment from 27 May 2015 till 26 June 2015 on the Digby Wells website (www.digbywells.com), and at the RLM, Bojanala District Municipality and Marikana Community Libraries.

Table 8-3 below provides a summary of the stakeholder engagement activities.

Table 8-3: Stakeholder Engagement Activities

Activity	Details	Reference in Report
Identification of stakeholders	Stakeholder database which, includes I&APs, from various sectors of society including directly affected and adjacent landowners in and around the project area.	Appendix B Stakeholder Database
Land Claims Commissioner	A letter was sent on the 16 April 2015 to the office of the North West Department of Rural Development and Land Reform: Land Claims Commission. The outcome of the enquiry is awaited.	Appendix D Land Claims Commissioner Letter and Response
Distribution of proposed project announcement materials	BID, announcement letter with Registration and Comment Form was emailed and posted to stakeholders on ***Friday, 6 March 2015.***	Appendix C BID, letter with registration and comment form
Placing of advertisements	An advertisement was placed in the Rustenburg Herald newspaper on Friday, 13 March 2015.	Appendix C Advertisement
Placing of site notices	Site notices (6) in English were put up at various public places within proposed project site, including the Local Municipalities	Appendix C Site notice report
Placement of Draft Section 102 Report	This Draft Section 102 Report is available for public comment from 27 May 2015 till 26 June 2015 on the Digby Wells website (www.digbywells.com), and at the RLM, Bojanala District Municipality and Marikana Community Libraries. The Draft EMP Amendment Report will also be made available on www.digbywells.com and will be available at the Open House meeting which is to be held. *(Comment period for the Draft EMP Amendment Report: 26 June 2015 till 27July 2015)*	
Announcement of the Draft EMP Amendment	A letter was emailed and posted to the full database to announce the availability of the Draft EMP Amendment Report and invite stakeholders to an Open House on 1 July	Appendix C Announcement Letter

Activity	Details	Reference in Report
Report	2015.	
Open House	An Open House will be held on 1 July 2015. All comments received at the meeting will be captured in the CRR.	Appendix E Comment and Response Report

Once the Draft Section 102 Report has been finalised after the public comment period and after the public meeting the draft report will be finalised and will be placed on the Digby Wells website.

8.3 Item 3(g)(iii): Summary of Issues raised by I&APs

At the time of submission for public comment of the Draft EMP Amendment Report, no stakeholder consultation had commenced. Feedback, comments and issues raised by I&APs from the Open House meeting and written submissions are included into the Final EMP Amendment Report for submission to the DMR. The details of correspondence with I&APs are summarised in Table 8-4, Table 8-5 and Table 8-6 below.

Table 8-4: Interested and Affected Parties

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
Landowners					
No comments were received from landowners					
Lawful occupier/s of the land					
No comments were received from lawful occupiers of land					
Landowners or lawful occupiers on adjacent properties					
No comments were received from landowners or lawful occupiers on adjacent properties					
Municipal councillor					
Cllr Lolo Molefe Ward 33 Councillor	Written Comment via- e-mail Open House Meeting	23 June 2015 01 July 2015	Not enough information is given to local business and all the tenders are advertised in Gauteng but we do not have access to the tenders. They do not get to bid on tenders put out by the mine as they are unaware of the process that needs to be followed and when these tenders are placed.	Through Enterprise Development, Lanxess has developed the local business which was previously recorded incorrectly under the Local Economic Development (LED) projects, that is the Belt Cleaning (by Chanana) and the Laundry (by KYBP). The procurement matters will be handled when Lanxess have a stakeholder engagement meeting. Lanxess' Social and Labour Plan (SLP) coordinator, Asaph Ngoepe gave assurance that, for LED projects, tenders will be sent out to the local community and encourage partnership to empower the small businesses in the area.	
Cllr Lolo Molefe Ward 33 Councillor	Written Comment via- e-mail	23 June 2015	A group of about 24 people were hired from a nearby ward and the responsible person was approached, but he made it clear that the hiring of the people was under instruction from the mine. The above is happening at the mine but it is for people who are from other wards, like ward 29.	The mine has established an internal process that no contractor should go through the recruitment process without consulting the SLP coordinator. The contractors are complying with the process. The mine has never instructed anyone to hire outside the jurisdiction of the local area in which the mine operates, unless this is for a scarce and critical skill, not available locally.	
Cllr Lolo Molefe Ward 33 Councillor	Written Comment via- e-mail	23 June 2015	Local people are not employed for example there are approximately 700 permanent employees on the mine and 80% of these employees are not from the local area and none are from my ward (Ward 33).	The mine is committed to employing locally in accordance with the SLP unless, as stated above, a particular skill set is deemed as critical, and not available locally	
Cllr Lolo Molefe Ward 33 Councillor	Written Comment via- e-mail	23 June 2015	We requested assistance for water/jojo tanks for the schools, as a result of water shortages in the schools,	This project was not approved in the beginning but had to be reviewed with regards to the project budget. The	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
			but I was sent a regret letter stating that the mine is busy with projects. I do not know of any projects in my ward	project has now been approved and the company will proceed with the project as part of the SLP.	
Cllr Lolo Molefe Ward 33 Councillor	Open House Meeting	1 July 2015	The issues are that there were commitments made in the Social and Labour Plan (SLP) around a Multi-Purpose Community Centre amongst other commitment made. The community has not been assisted with any infrastructure.	The DMR has audited the SLP and has instructed Lanxess to replace some project and implement projects not actioned to date.	
Cllr Gabriel Khunou	Open House Meeting	1 July 2015	We would like to see timelines for implementation of SLP projects. We want commitments from Lanxess otherwise the process of the Section 102 EMP amendment will not continue. We will communicate with the Department of Mineral Resources (DMR) directly.	Lanxess will submit a report including timelines for the implementation of SLP projects and will also submit the Human Resource Development (HRD) reports.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	Local companies are to be appointed to sweep the road and stockpile chrome, particles are to be swept into bins and given back to Lanxess	All the SMMEs and Enterprise development are channelled through procurement and currently the Procurement is doing the good job to ensure that preference is given to local companies when tender procedures are followed.	
Municipality					
No comments were received from the Municipality					
Organisations of state (Responsible for Infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.					
No comments were received from organs of state					
Communities					
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	Agriculture activities to produce food and employment, we have to feed ourselves for us to be self-sustained therefore our role is to create an enabling environment which will allow our farmers to maximize their potential	Lanxess currently has the Fertiliser Project on the SLP and Lanmxes will assist in any agricultural projects should it be identified by the community as one of the needs, in consideration will all the resources available.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Open House Meeting	1 July 2015	Concerned that a legal process has been followed in terms of the Section 102 Amendment but not a moral process as we are only informed once the report has already been drafted. Which phase of consultation is the project in?	The Section 102 Amendment process is a shorter process compared to what is required as part of a comprehensive EIA process. Unlike the EIA process that goes through an announcement, application, Scoping and EIA Phase, this process essentially only has an announcement phase after which the Draft document for submission is made available for public comment (which is presented at a public meeting or	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
				Open House Meeting). However, it is important to emphasize that the engagement process is not complete and is a continuous process.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	The public consultation process was not done correctly, The Public Consultation process is designed to provide sufficient and accessible information to I&APs in an objective manner to assist them to: ▪ Raise issues of concern and make suggestions for alternative and enhance benefits; ▪ Contribute local knowledge; ▪ Verify that their issues have been captured; ▪ Comment on the finding of the impact assessment.	Ample opportunity was provided to I&APs to meet these objectives. I&APs had an opportunity to comment on the Background Information Document (BID) made available in the beginning of the process and I&APs were invited to submit comments or suggestions during the course of the entire project. Furthermore, at the stage that the Open House Meeting was held, the document was not final and I&APs yet again had an opportunity to review the 102 Amendment document and comment.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	Chrome falls off during transportation to Bleskop railway siding. Trucks damage our roads therefore this needs to be managed.	Comment noted. Mitigation measures set in place to manage impacts associated with the mining operation has been detailed in the EMP. It will be the responsibility of the Mine to ensure these measures are implemented. Comment noted. Mitigation measures set in place to manage impacts associated with the mining operation has been detailed in the EMP. It will be the responsibility of the Mine to ensure these measures are implemented.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	Healthy environmental leads to healthy living so it is imperative to secure our environmental and avoid all kinds of pollution where pollution is already taking place steps have to be taken to maintain, regulate and reduce it. Dust is a serious hazard causing (pheumocanions)	Comment noted. Mitigation measures set in place to manage impacts associated with the mining operation has been detailed in the EMP. It will be the responsibility of the Mine to ensure these measures are implemented.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	Explosives vibrate the land which affects our Houses.	All blasting will take place on the mine property and the surrounding properties are also mines blasting will not affect community houses.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	Water for dust allaying and large group of disease on the respiratory organs caused by the inhalation of noxious dust so animals eat grass, plant having dust, During your Meta Murgical process Lanxess Mine use	Comment noted. Mitigation measures set in place to manage impacts associated with the mining operation has been detailed in the EMP. It will be the responsibility of the Mine to ensure these measures are	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
			Chemical reaction to leaching and use Sodium, Calcium etc.	implemented.	
Mr Simon Malesela Lesame Clan Mmakhunou (Treasure)	Registration Form	28 July 2015	Land usage is residing at Photsaneng Village where all activities' of farming, soil erosion, loss of natural vegetation is taking place.	Comment noted. Mitigation measures set in place to manage impacts associated with the mining operation has been detailed in the EMP. It will be the responsibility of the Mine to ensure these measures are implemented.	
Mr Mogotsi Huma	Open House Meeting	1 July 2015	Appreciates commitments made by the SLP coordinator. He understands that not all historical issues can be addressed. But would like the mine to start somewhere.	SLP coordinator committed to send information as a start in the process of addressing issues.	
Mr Mogotsi Huma Entrepreneur	Open House Meeting	1 July 2015	Will the additional 80 000 tons result in additional trucks on the roads.	There will be additional trucks on the internal mine roads but not on the outside roads.	
Traditional Leaders					
Headman Victor Khunou	Open House Meeting	1 July 2015	The pervious SLP manager made commitments which were not met and therefore they want to meet with the CEO.	The SLP coordinator will arrange a meeting with the CEO.	
Department of Land Affairs					
No comments were received from the Department of Land Affairs					
Department of Environmental Affairs					
No comments were received from the Department of Enviornmental Affairs					
Other Competent Authorities Affected					
No comments were received from other competent authorities					

Table 8-5: Other affected parties

Other Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
No comments were received from other affected parties					

Table 8-6: Interested parties

Interested Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
No comments were received from interested parties					

8.4 Item 3(g)(iv): The Environmental Attributes Associated with the Development Footprint Alternatives

The socio-economic, heritage, cultural, geographical, physical and biological attributes associated with the development footprint are detailed in this section.

8.4.1 Baseline Environment

8.4.1.1 Type of Environment Affected by the Proposed Activity

8.4.1.1.1 Air Quality (Please refer to detailed report in Appendix G)

It is important to note that the baseline covers the project area and the modelling takes into account the activities for both the underground (transport of ore to the surface and processing) and opencast operations (construction activities and operational activities).

The Mine falls in the Waterberg Bojanala Priority Area (WBPA), which encompasses the Waterberg District in Limpopo Province and the Bojanala Platinum District in the North West. This district has several sources of pollution such as heavy industry, refinery, power station, motor vehicles, small industries and households that rely on coal for cooking and space heating).

The current air pollution sources of concern in the Waterberg District are:

- Dust from mines, quarries, brickworks, spoil/overburden heaps and heavy vehicles using gravel roads;
- Burning of solid waste at waste disposal sites, informal waste dumps;
- Tailpipe emissions especially heavy vehicles that drive through towns; and
- Use of biomass for cooking and space heating.

To determine the baseline conditions for the project area, site specific (meso-scale model) MM5 modelled meteorological was utilised to determine local prevailing weather conditions. Predominant winds come from the east and east northeast respectively. Over the three year period, frequency of occurrence was 11.8% from the east, 10.5% east northeast, and 9.9% from northeast. Calm conditions (wind speeds < 0.5 m/s) occurred for 4.7% of the time. The average monthly maximum temperatures range from 13.3°C in July to 25.7°C in February, with monthly minima ranging from 12°C in July to 25.1°C in January and the maximum relative humidity of 76.4% in July and the lowest of 55.9% was achieved in November.

The surrounding sensitive receptor (residential) areas include:

- Wigwam – approximately 9 km to the south west;
- Kroondal – approximately 5 km to the west;
- Marikana – approximately 8 km to the north east;
- Buffelspoort – approximately 9 km to the south east;

- Lapologang – approximately 6 km to the east;
- Waterkloof – approximately 5 km to the north west; and
- Nkaneng – approximately 2 km to the north of the project boundary.

Dust Deposition Monitoring

Lanxess have been monitoring dust deposition rates at 10 monitoring points in the vicinity of its operations. Two additional sites were commissioned from April 2013 resulting in a 12 point network. To date a complete set of results have only been received for all sites up until August 2014 (please refer to Figure 8-1).

According to the margin of tolerance within the AQ standards for a non-residential area, the limit may be exceeded twice in one year however this should not be in sequential months.

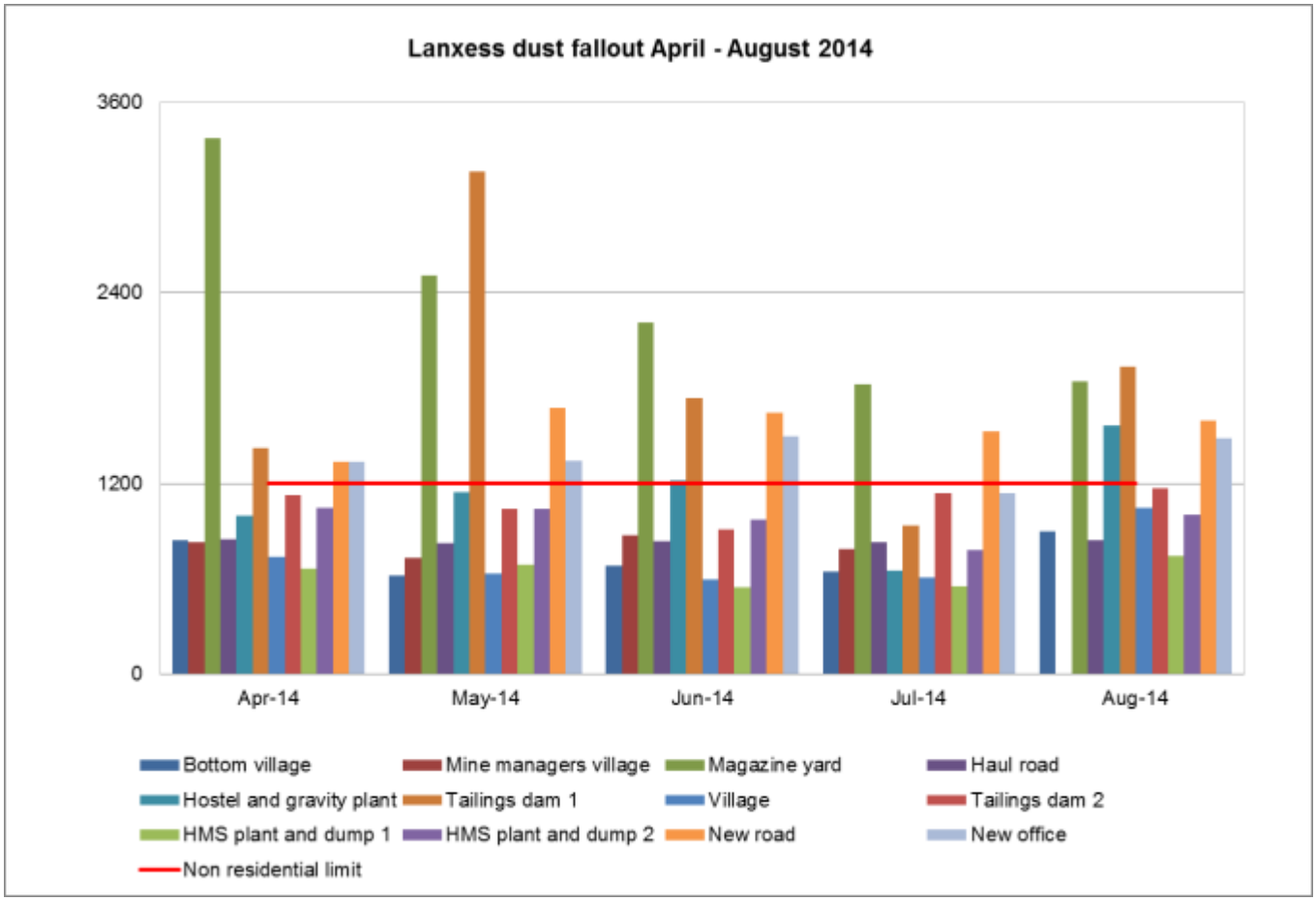

Figure 8-1: Lanxess dust fallout results April – August 2014 (Lanxess, 2015)

From May to August 2014, the monitoring sites at the magazine yard, new office and new road all recorded deposition rates in exceedance of the limit for more than three consecutive

months. This is in violation of the recommended frequency of exceedance of two. These monitoring points and the dust fallout results are detailed in the Air Quality Report.

Dispersion Modelling

Dispersion models are used to predict the ambient concentration in the air of pollutants emitted to the atmosphere from a variety of processes (South African National Standards - SANS 1929:2011). All emission scenarios have been simulated using the USA Environmental Protection Agency's Preferred/Recommended Models: AERMOD modelling system. The receptor grid has been chosen to include the nearest sensitive receptors these are mainly surrounding farms and residential dwellings (see Figure 8-2) and provide an indication of the extent of any air pollution impacts. The modelling has been performed using the meteorological data discussed in previous section and the gaseous, particulate and deposition emissions calculations. An emissions inventory was established comprising emissions for the different activities associated with the Lanxess operations. These included material handling operations from both opencast and underground (e.g. tipping, storage and conveyors coming from below ground to the surface), vehicle activity on haul roads and access routes as well as wind erosion of stockpiles.

Modelling Results

The following pollutants were assessed:

- Total Suspended Particulates (TSP);
- Particulates with aerodynamic diameter of ≤10 µm (PM_{10}); and
- Particulates with aerodynamic diameter of ≤2.5 µm ($PM_{2.5}$)

These were assessed within the mines boundary or property (which include current and proposed mining operations) and at the 8 sensitive receptors seen below in Figure 8-2.

Results were similar for both PM_{10} and $PM_{2.5}$ as standard levels were exceeded within the mine property for both a 24 period and as the annual levels. However all of the sensitive receptors located outside the mine did not exceed these standard levels. This indicates that the potential health risks are more significant for the exposed workers on site.

Table 8-7: Modelled concentrations of pollutants within the mine area

	24 hour period	Annual levels
PM_{10}	191 µg/m³ (75 µg/m³)	43 µg/m³ (40 µg/m³)
$PM_{2.5}$	187 µg/m³ (65 µg/m³)	28 µg/m³ (25 µg/m³)

* Concentrations in brackets indicate standard levels as per non-residential areas. Concentrations in red exceed the limit.

In terms of dust deposition, the predicted deposition rates are in agreement with the measured data. The highest dust fallout level was predicted to occur outside of the mining

right area, but within the mine's operational area (2 292 mg/m²/day). The deposition rates predicted for the different sensitive receptors were all below the 1 200 mg/m²/day limit for a non-residential area. When the mitigation measures (dust suppression measures) were implemented, the dust fallout level in the project boundary reduced to 1 604 mg/m²/day and the anticipated fallout dust at the sensitive receptors reduced even further. The dust deposition represented below in Figure 8-2 indicates the area impacted without mitigation measures.

The main sources of dust generation from the proposed activities will be the dump, opencast operations and haul roads.

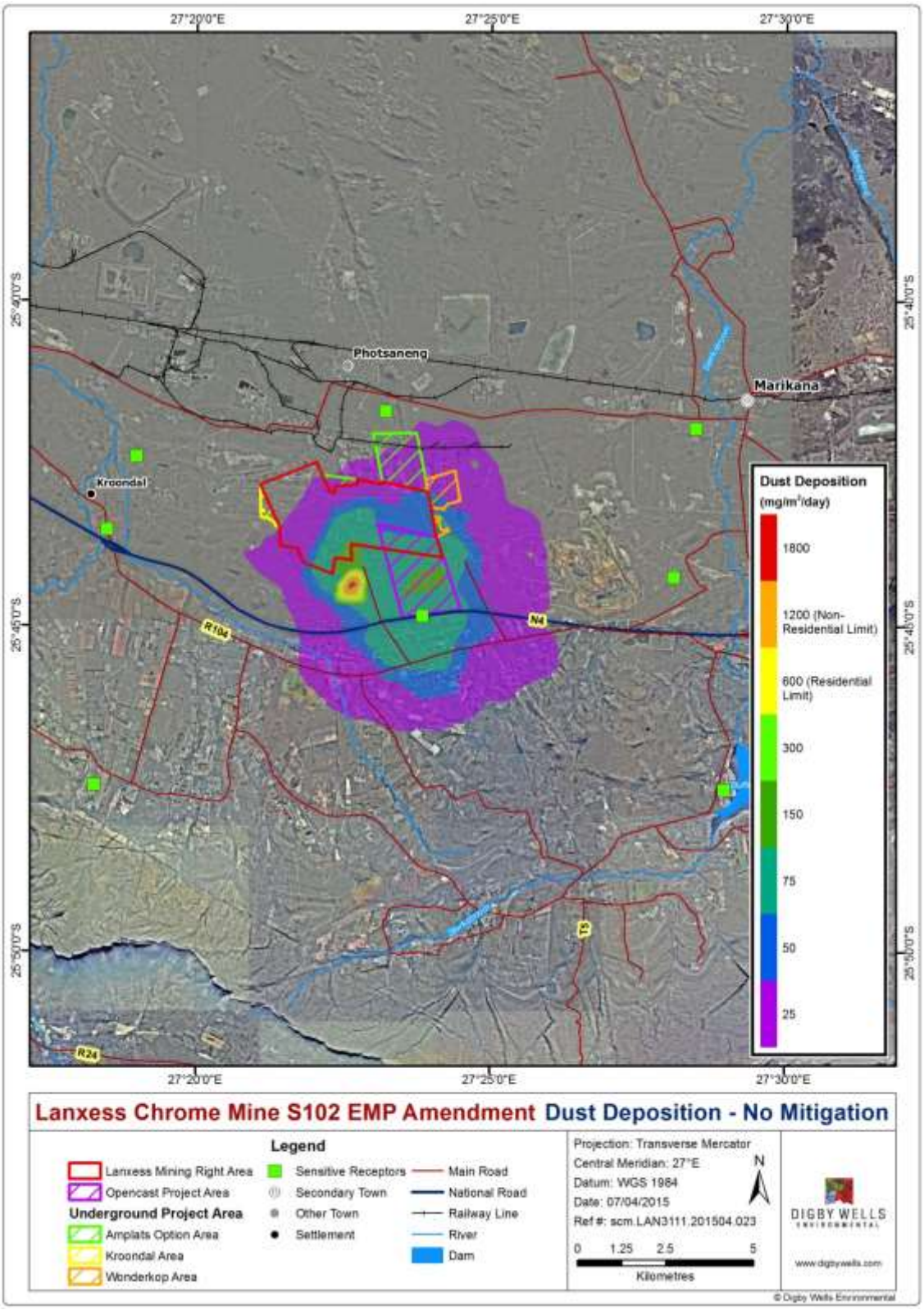

Figure 8-2: Predicted 30-days average (100th percentile) dust deposition (mg/m²/day) due to the Lanxess operations ctivities without mitigation. Lanxess boundary highlighted in red and the sensitive receptors in green

8.4.1.1.2 Fauna and Flora (Please refer to detailed report in Appendix G)

The project area (including both underground and open pit operations) is located in the Savanna Biome of South Africa. The dominant vegetation type, according to literature for the proposed development area is Marikana Thornveld, formally classified as an endangered vegetation type nationally with none conserved and 55% altered, primarily by cultivation.

As there is not expected to be any surface disturbance as result of the additional underground sections (and therefore minimal impact on fauna flora), this field study focused on the open pit operations and the associated infrastructure such as the dumps and the haul roads. This report will identify species and habitat of potential concern associated with the proposed opencast project area.

A total of 71 plant species were recorded on the open pit area. Of these, one is regarded as a Species of Special Concern (SSC), *Boophone distcha*, with no plants on the national list of Protected Trees. Nine invasive species were recorded from Schedules 1 and 3 of Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA). No mammal species were recorded on site. Twenty one bird species were recorded, none of which are protected, and one reptile species. No amphibian species were recorded on site.

Sensitivity

From the information that was interrogated for this report it is evident that the overall project area does occur within the Magaliesberg and Witwatersberg Important Bird Area. The study area occurs within Marikana thornveld which is a threatened ecosystem, however through site investigation it was found that much of the project area has been transformed due to agricultural and mining activities. The study area does not form part of the NPAES. As far as protected species are concerned, broad scale data was available for the mammal determination and there are protected species that can occur on the Lanxess site, as listed in this report. No protected reptile species are expected, and none were encountered, no protected amphibian species are expected.

The underground segments are heavily disturbed by past agricultural practises of overgrazing as well as the current mining activities. No natural vegetation is present on the sites and the areas are dominated by alien species.

The open pit operation area can be divided into two main sections Transformed and Natural land. Certain areas of the study site are currently being used for commercial farming, more specifically Sorghum (*Sorghum bicolor*). Whereas other areas of the site on hill slopes remain largely natural with some disturbance from grazing evident. Some parts of the study site are difficult to access and, from a farming perspective, and as a result, are in an unaltered condition. These relatively pristine areas tend to be on hill slopes and crests of the Koppie areas that are very rocky (Figure 8-3).

There is a potential chance to encounter additional protected species in the remaining natural areas on site despite them being isolated (Figure 8-4). These areas therefore need to be seen as potentially sensitive and mitigation measures have been provided accordingly in the EMP.

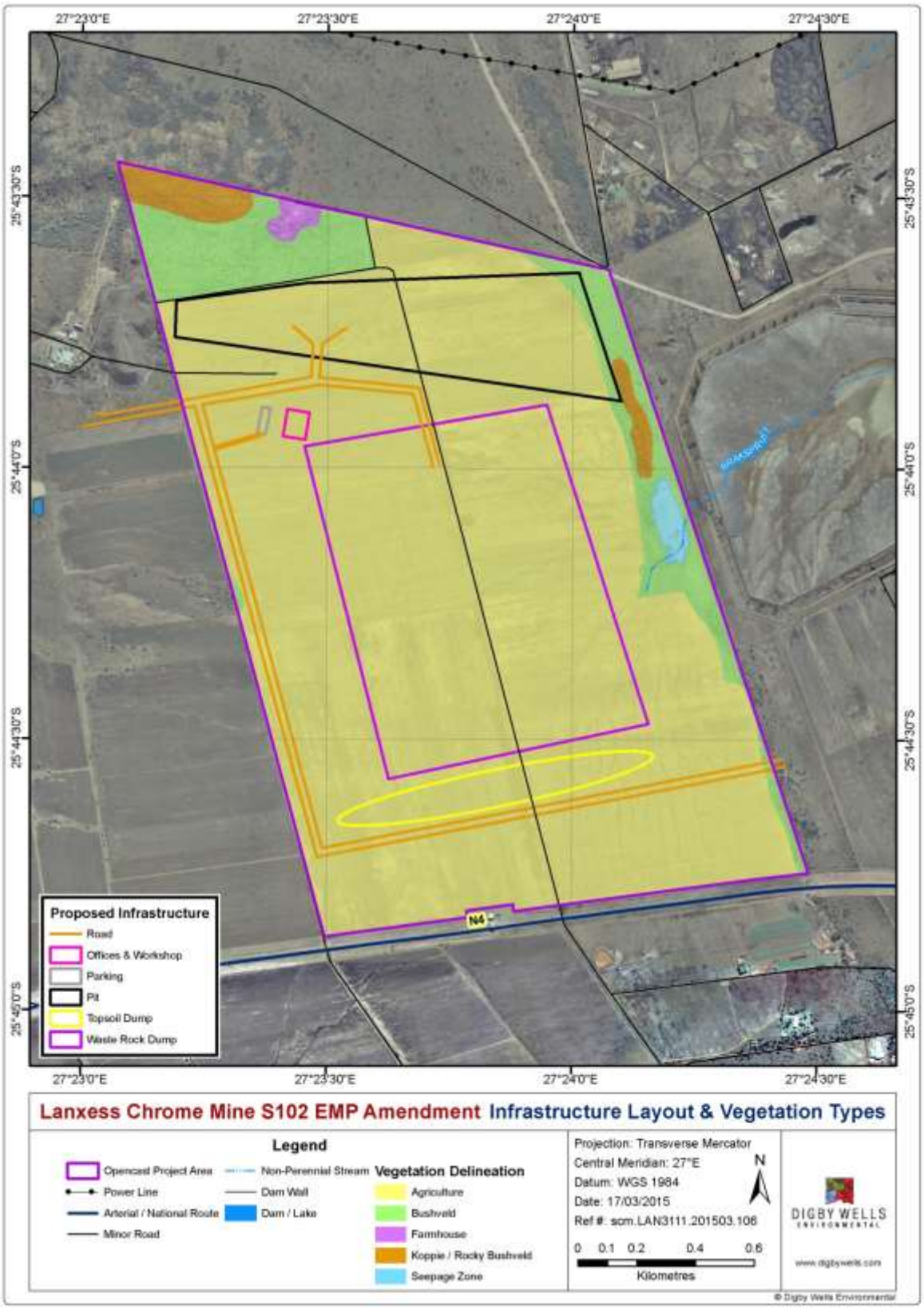

Figure 8-3: Vegetation communities and basic infrastructure layout

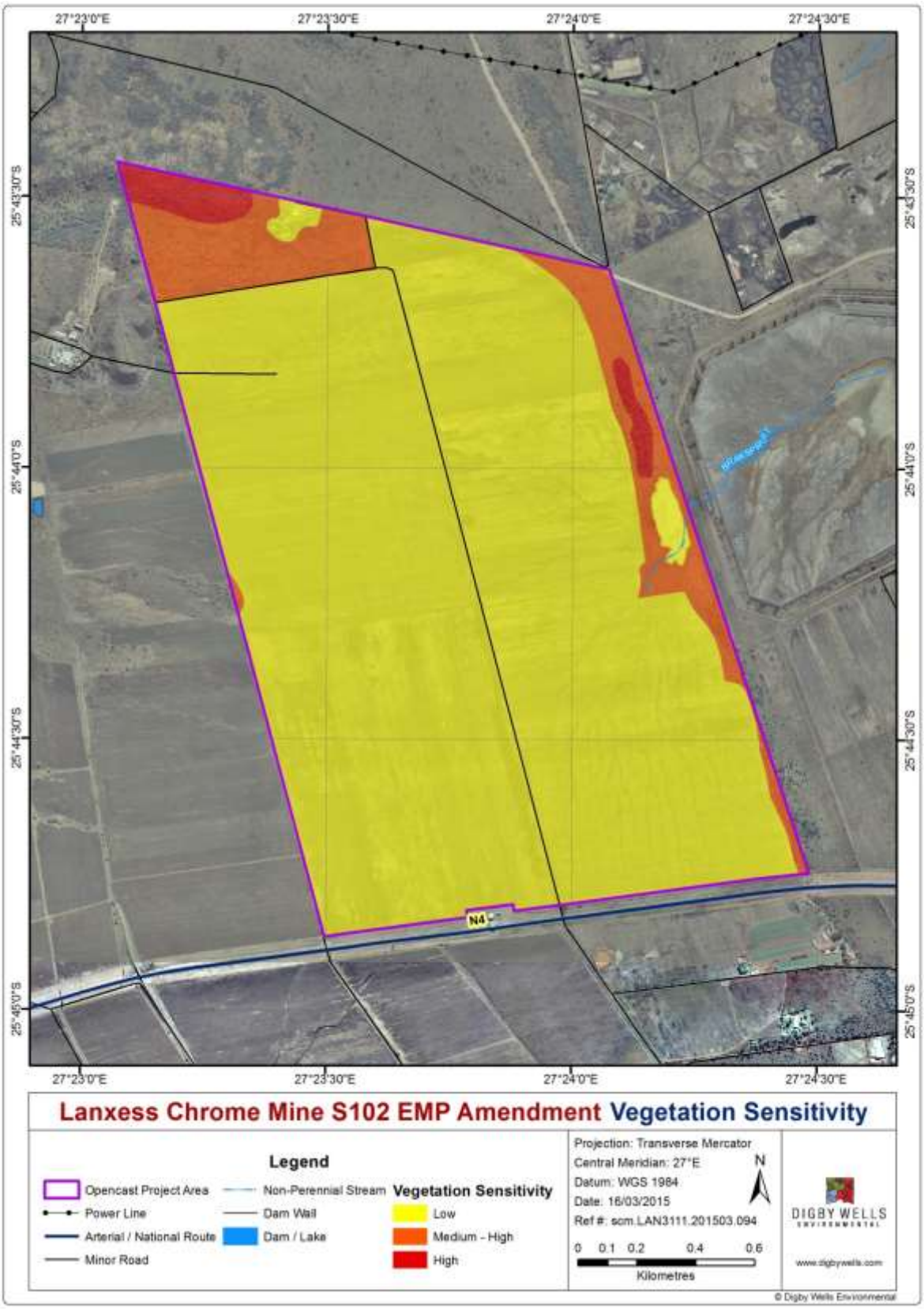

Figure 8-4: Ecological sensitivity on site

8.4.1.1.3 Surface Water (Please refer to detailed report in Appendix G)

Catchments

The project area (including the opencast and underground operations) are located in the Crocodile West and Marico Water Management Area (WMA 3) within the A22H quaternary catchment. The eastern boundary of this project area lies on the catchment divide between quaternary catchments A22H and A21K as seen below in Figure 8-5.

The surface water attributes of the affected catchments namely the Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR) and Mean Annual Evaporation (MAE) are summarised in Table 8-8 (WRC, 2005) below.

Table 8-8: Summary of attributes of quaternary catchments

Quaternary Catchment	Total Area (km^2)	MAP (mm)	MAR $m^3 * 10^6$	MAE (mm)
A22H	579	658	9.11	1700
A21K	865	651	14.07	1700

The A22H quaternary catchment area is 579 km^2, and has an MAR of 14.07 million cubic meters (mcm). Runoff emanating from this quaternary catchment drains in a north easterly direction via the Hex River. Elevations in the A22H quaternary range from 1 220 meters above mean sea level (mamsl) at the highest point within the catchment, and drop to 1 112 mamsl at the outlet of the catchment. The A21K quaternary catchment area is 865 km^2, and has an MAR of 9.11 mcm. Runoff emanating from this quaternary catchment also drains in a north easterly direction via the Sterkstroom River.

The project area is located in the south-eastern side of the A22H quaternary catchment on the watershed of the A22H and A21K quaternary catchments. Average slopes for the western project boundary range from 0.7 % to -1.0 % for the majority of the area, whilst the steeper slopes are located on the western and eastern boundary of the project area and range from 0.3 % to -2.1%.

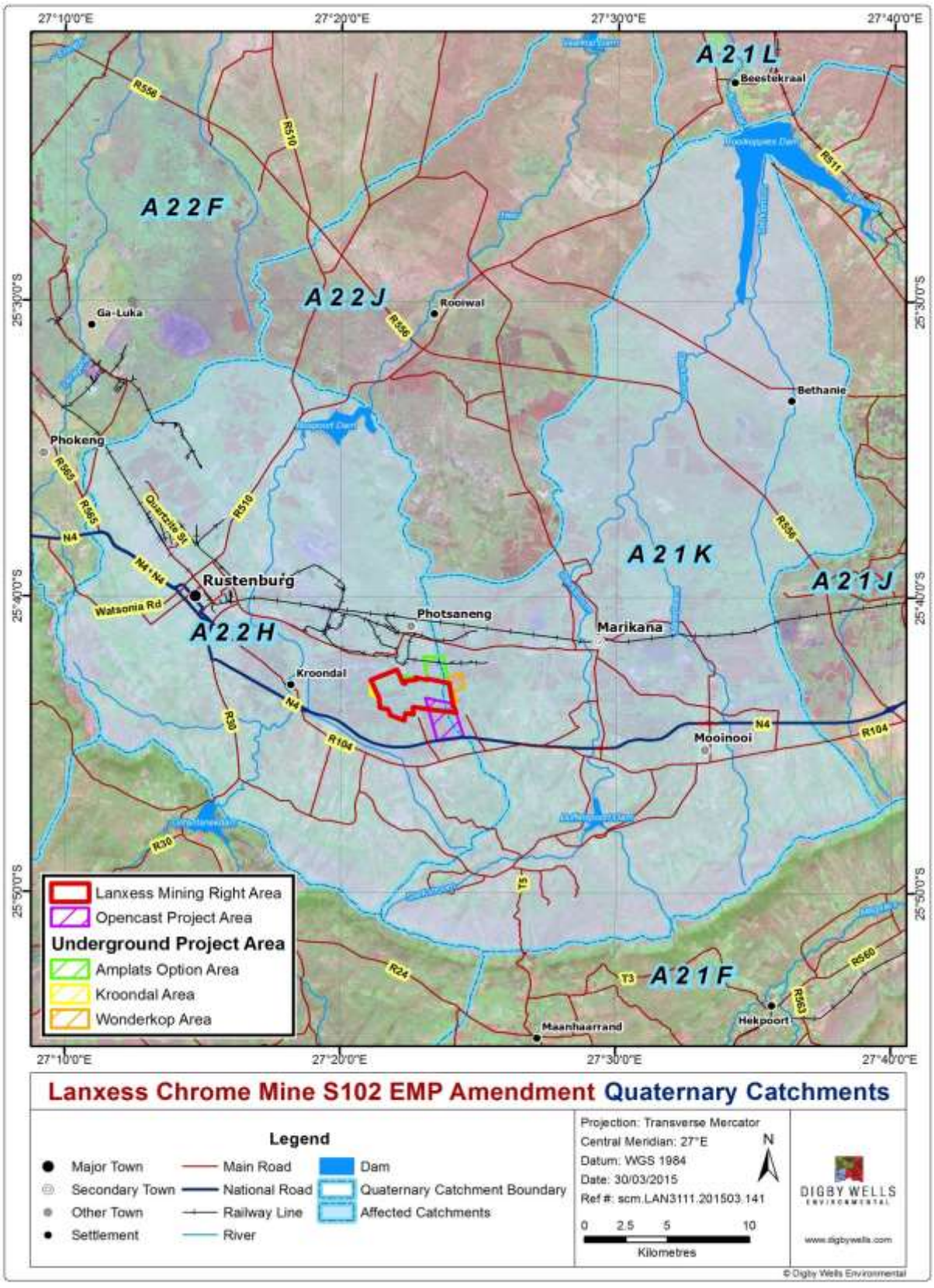

Figure 8-5: Regional hydrological setting

The main water course in the A22H quaternary catchment is the Hex River found on the western side of the project area, this river joins the Elands River which is a tributary to Crocodile River. There are two major tributaries to the Hex River namely the Sandspruit and Waterkloofspruit. The Sandspruit flows from the south of the project area in a north-westerly direction joining the Hex River. The Waterkloofspruit is located on the western side of the project area and it flows in a north easterly direction to also join the Hex River in the north.

On the eastern side of the project area is the A21K quaternary catchment which consists of four rivers/streams namely: the Sterkstroom, Kleinwater, Tshukutswe and the Maretlwana River. The Sterkstroom River is the main river in the mentioned quaternary catchment and it drains in a north easterly direction into the Crocodile River which is a tributary to the Limpopo River.

Water Users

The mine does not utilise water from any local surface water resources for its activities, with Rand Water being the primary supplier of water to the mine.

Due to the non-perennial nature of the unnamed streams around the project area, there are limited surface water users that are registered on the Department of Water and Sanitation (DWS) Water Users Registration Management Systems (WARMS) database. The farmers downstream (west of the project area) utilise water from small farm dams together with the Holthausen Dam, which is 4 km away from the site, for agricultural purposes such as irrigation, stock feed and livestock watering. Other surface water uses identified for A22H quaternary catchment include:

- Industry (Urban); and
- Mining.

Water Quality

The monitoring is conducted at the slimes dam, HMS Plant Circular dam, Gravity Plant dam and Return Water dam (RWD). Elevated levels of Nitrates (NO_3) have been observed in all the dams on the 2014 monitoring results. The elevated levels of Nitrates (NO_3) could possibly be as a result of contamination of water from the explosives waste material underground. Ammonia (NH_4) and Aluminium (Al) in the GRA and HMS dams is were also above the limits in November to December 2014. Other water quality parameters were found to be within the limits (please refer to Table 8-9). Elevated levels of Nitrates (NO_3) have again been observed in all the dams on the 2014 monitoring results. This has not shown any improvement as these levels were also exceeding the limits in 2010 except for the Rand water supply used for drinking. The elevated levels of Nitrates (NO_3) could possibly be as a result of contamination of water from the explosives waste material.

Ammonia (NH_4) and Aluminium (Al) in the GRA and HMS dams is were also above the limits in November to December 2014 monitoring period. Other water quality parameters were found to be within the limits. Although Sulphate (SO_4), Magnesium (Mg) and Manganese (Mn) were above the recommended aesthetic quality limits, they were still within the

maximum allowable water quality limits. In general, all the water in the three dams is regarded as waste water and cannot be used for drinking.

Table 8-9: Surface water chemical results (November & December 2014) of Lanxess monitoring points benchmarked with SANS 241: 2011 Water quality guidelines

Sample ID	Total Dissolved Solids	Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulphate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe (µg/l as Fe)	Manganese as Mn (µg/l as Mn)	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al (µg/l as Al)	Free and Saline Ammonia as N	Fluoride as F
(Aesthetic quality Recommended)	<1200	<10	<300	N/S	<250	<150	<70	<200	<50	<300	<100	<170	5-9.5	<300	<1.5	<1
(Drinking water quality Max. Allowable)	2400	11	600	N/S	500	300	100	400	100	<2000	500	370	4-5 or 9.5-10	0.5	2	1.5
Exposure Duration (years)	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs
Slimes Dam-HMS	1371	189.00	85.2	0	253.0	134.0	93.8	132.0	15.10	14270.00	135.00	163.0	7.05	1777.00	21.80	0.69
Slimes Dam-GRA	854	104.00	61.0	0	168.0	92.6	45.6	85.5	12.60	41.00	0.00	141.0	7.23	17.00	8.50	0.58
Slimes Dam-RWD	996	98.00	132.0	0	256.0	67.0	98.9	119.0	10.80	0.00	0.00	162.0	8.91	0.00	0.00	0.60
Slimes Dam-HMS	725	121.00	74.0	0	246.0	99.9	40.1	98.7	8.80	1170.00	155.00	165.0	7.62	803.00	10.60	0.71
Slimes Dam-GRA	755	118.00	66.8	0	221.0	107.0	56.0	95.2	10.70	606.00	146.00	165.0	7.88	810.00	7.10	0.68
Slimes Dam-RWD	715	70.00	132.0	0	256.0	50.3	86.7	85.2	6.80	24.00	19.00	154.0	9.21	12.00	0.00	0.65
Rand water(Domestic Use)	133	1.0	12.2		15.6	24.5	6.7	11.6	3.9	37	0.00	28.0	7.66	0.00	0.00	0.38

8.4.1.1.4 Geohydrology (Please refer to detailed report in Appendix G)

It is important to note that the baseline covers the project area and the modelling takes into account both the underground and opencast operations.

Aquifers and Yields

The weathered aquifer in the Lanxess Chrome Mine area stores the bulk of the groundwater in the area and also forms the main recharge zone. This aquifer occurs across the entire surface area of the proposed pit. With a saturated thickness of up to 26 m, this aquifer dips towards the south eastern portion of the proposed pit.

JMA Consulting (2009) stated that the weathering depth at the Wonderkop underground segment varies between 9 and 25 mbgl, with the average depth being 15 m. The weathering profile is unevenly distributed across the Wonderkop site, but it does appear as if the depth of weathering could be slightly deeper towards the north. In view of the data gaps for the Klipfontein and Kroondaal sections, a conceptual weathering depth of 20 mbgl is assumed as the profiles is unevenly distributed appearing to be slightly deeper towards the north.

After modelling several hypotheses, it was concluded that there exists higher yielding groundwater bearing fractures north of the east-west dyke that traverse the mine voids. However, the north-south dykes in the study area are very low yielding. Rainfall recharge to the groundwater system is expressed as a percentage of the MAP. The MAP used for the site is 645 mm/annum. The mean annual recharge (MAR) to the groundwater systems for the study area is estimated to be between 3% and 7% of the mean annual precipitation (MAP), putting it in the recharge range of 20 mm/annum to 45 mm/annum (JMA Consulting, 2009).

Groundwater Levels

Levels are not monitored at Lanxess Chrome Mine. However, from the most recent studies conducted by Digby Wells, the depth to groundwater within the open pit operations ranges between 10 and 24 m, with an average of 16 mbgl. Based on the depth of weathering recorded during drilling, the deeper groundwater levels in LANBH01 and LANBH02 indicate that the weathered aquifer is unsaturated, most likely due to mine dewatering impacts. The water level in LANBH01 also indicates that seepage from the adjacent waste rock dump is not towards the proposed pit as infiltration from the waste rock dump would have elevated the groundwater level in borehole LANBH01. See Figure 8-6 for the location of the boreholes on site.

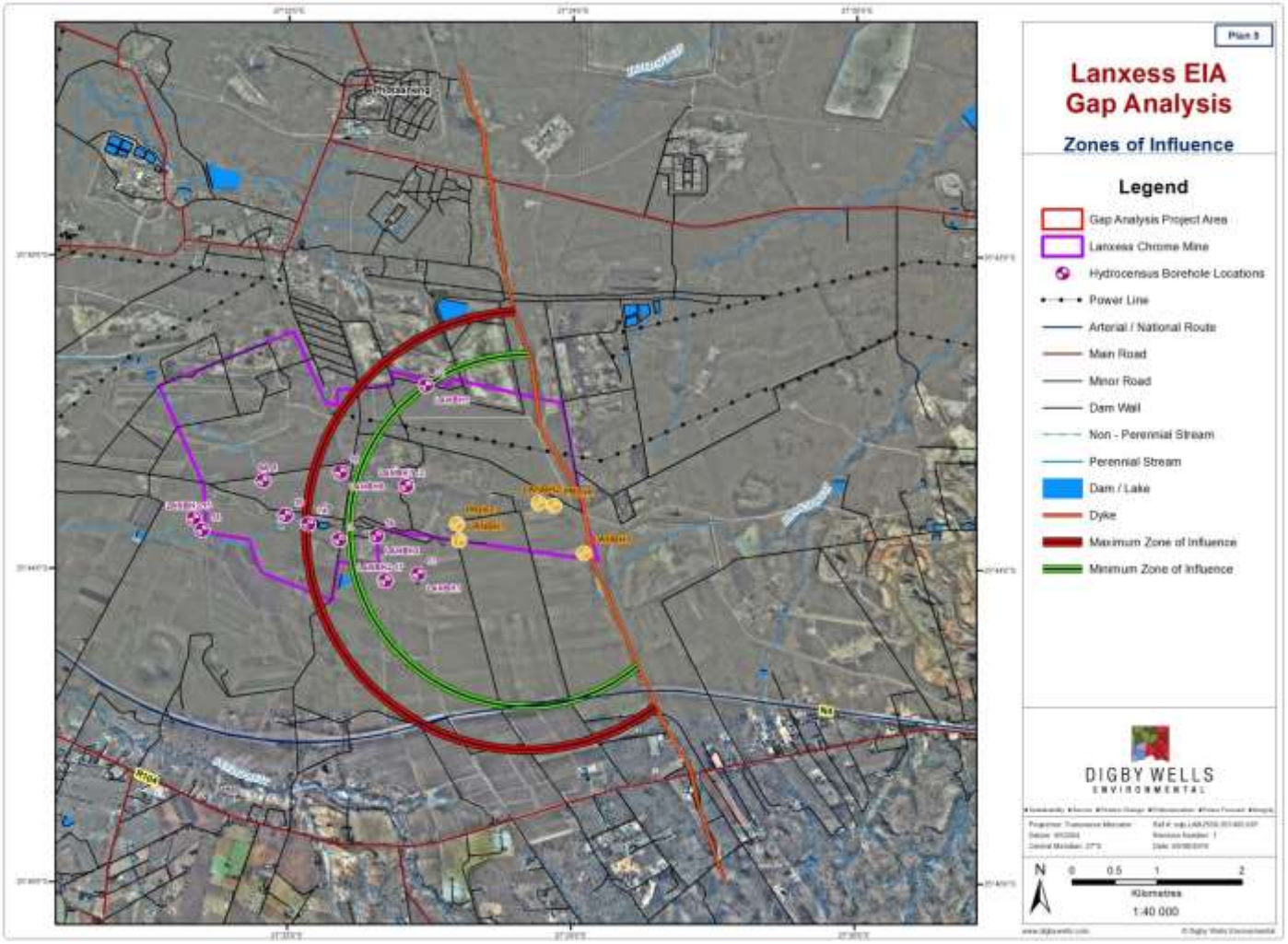

Figure 8-6: Borehole locations

The shallow groundwater level in LANBH01 (10 mbgl) indicates the thick weathered aquifer south east of the proposed pit is saturated and mine dewatering is less significant in this area. The groundwater elevation data indicates that groundwater flows from the south eastern perimeter of the pit in north-westerly direction. Historical boreholes, with water levels less than 11 mbgl, were plotted against surface elevations. It can be concluded that the regional shallow groundwater levels are less influenced by underground mining and correlate with topography. Therefore, the groundwater levels below 11 mbgl can be used for steady model calibration purposes.

Groundwater Quality

The groundwater quality results (Table 8-10) have been compared to the South African National Standards (SANS 241:2005) for Drinking Water and have been grouped into Classes in accordance with the above stated standard.

Table 8-10: Groundwater quality

Sample ID		pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulphate as SO_4	Fluoride as F	Nitrate NO_3 as N	Total Alkalinity as $CaCO_3$	Iron as Fe	Manganese as Mn	Aluminium as Al	Chromium as Cr
Class I	(Recommend)	5-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	<1	<10	N/S	<0.2	<0.1	<0.3	<1
Class II	(Max. Allowable)	4-5 or 9.5-10	150-370	1000-2400	150-300	70-100	200-400	50-100	200-600	400-600	1-1.5	10-20	N/S	0.2-2	0.1-1	0.3-0.5	1-5
	Duration	No Limit	7 years	7 years	7 years	7 years	7 years	7 years	7 years	7 years	1 year	7 years	N/S	7 years	7 years	1 year	
LANBH6		7.93	135	974	71	**135**	38	7	71	243	0.25	**42**	367	0.00	0.00	0.00	0.00
LANBH2		7.61	113	766	64	**125**	15	3	15	108	0.17	**39**	432	0.00	0.00	0.00	0.00
LANBH3		7.73	123	779	43	**158**	8	4	49	109	0.22	**32**	441	0.00	0.00	0.00	0.00
LANBH7		8.10	127	925	86	**108**	45	10	58	228	0.17	**41**	344	0.00	0.00	0.00	0.00
LANUG1		7.85	**155**	**1226**	145	56	145	15	107	**520**	0.12	**27**	194	0.00	0.00	0.00	0.00
LANBH01		8.13	93	535	30	**110**	12	3	15	39	0.26	**14**	435	0.00	0.00	0.00	0.00
LANBH02		7.70	113	635	63	**102**	32	7	26	114	0.50	5	441	0.00	**0.39**	0.00	0.00
LANBH03		7.84	109	641	61	**121**	17	4	15	76	0.26	**10**	502	0.00	0.00	0.00	0.00

Yellow text indicates figures within the Maximum Allowable Range. Concentrations in red indicate exceedance of this limit.

The following conclusions are drawn:

- The neutral to alkaline pH of the groundwater system implies that conditions for heavy metal solubility are not favourable, hence there is restricted migration for potential heavy metals in groundwater system;
- All boreholes show drinking water compliance in terms of electrical conductivity (EC) and total dissolved solids (TDS) levels;
- LANUG1 represents water discharged from the old underground workings at the concrete pipe, slimes dam drain. The Class II levels for EC and TDS indicate that some form of impact could potentially exist on the groundwater quality in the old working;
- The Class II sulphate concentration (LANUG1 at 520 mg/L) accounts for the elevated EC and TDS noted above;
- Calcium occurs naturally in the groundwater system and all boreholes are fully compliant with the calcium Class I limit;
- The non-compliant magnesium levels in groundwater can be attributed to a high solubility of the magnesium contents in the rock matrix. No other external sources of magnesium can be justified at this stage;
- In terms of nitrate it is only borehole LANBH02 that falls within the acceptable water quality limits. Five of the eight boreholes indicate groundwater not suitable for human consumption due to the high nitrate concentrations;
- The total chromium content in groundwater is below detection limit; and
- The published groundwater quality information for the regional aquifers indicated that nitrate could be elevated in the background groundwater quality and therefore it should not be used for impact identification. The results show that boreholes LANBH2 and LANBH3 are compliant, LANBH01 is marginally compliant and the rest are not compliant.

All the samples except LANUG1 have the same water type; dominated by magnesium and bicarbonates. It has also been demonstrated that boreholes LANBH6 and LANBH7 are being influenced by water from old or current underground workings. It can be said that the current impacts on groundwater around the proposed pit lies in the vicinity of the old or current underground workings.

Groundwater Use

At Wonderkop Mine, water abstracted from boreholes GCS-1, GCS-4, GCS-5, GCS-6, WH-6 and Bokamoso boreholes is used solely as process water during operation of the ferrochrome plant, as well as the Bokamoso Pelletizing Plant. The maximum permissible volume of groundwater than can be abstracted is 149 560 m^3 per annum (JMA, 2009).

According to both Aquarius and Anglo Platinum, no groundwater is abstracted from boreholes within the study area. Both Aquarius Platinum (No. 4 Shaft) and Anglo Platinum (Brakspruit Shaft) abstract their ground water directly from the mine workings. The water that is abstracted from Aquarius' No 4 shaft is used solely as process water during mining operations and is used on the tailings dam to the south of the Wonderkop property. Anglo Platinum's Brakspruit shaft uses an average of 430,848 L/d as process water during mining operations. A further 30,000 L of water is pumped out of the mine and used on the tailings dam to the north of the study area on a daily basis (JMA, 2009).

Modelling results – Underground Sections

Numerical models are commonly used to develop hydrogeological management solutions that include the prediction of contaminant plume migration and groundwater level changes over time.

Minor seepage may be encountered during the decline shaft construction. The groundwater model predicts the inflow to rise into the current underground operations to a maximum of 540 m^3/d in 2025. This estimate is broadly comparable to anecdotal information from the historical mining activity at Lanxess which suggests that a dewatering rate of approximately 500 m^3/d was required to keep the underground workings dry. The groundwater inflows into the shafts may lead to localised dewatering. It is anticipated that the low permeability bedrock will naturally mitigate the progress of the cone of depression around the decline shaft. The 5 m drawdown cone is not predicted to migrate more than 1 km from the proposed extension segments due to the low permeability associated with the deep fractured aquifer. In the weathered aquifer, mining in the new segments is not expected to cause additional dewatering, no more than already impacted. Interestingly, the model predicts that the 1 m drawdown cone will be limited to the west of the catchment diving dyke. As groundwater is used on ad hoc basis, the impacts on groundwater quantity during the operational phase are therefore not significant.

There has been a concern that mining underneath the slimes dam at Kroondal, Klipfontein and Wonderkop segments will induce seepage from these facilities to the underground mine. The groundwater model predicts that any seepage emanating from the overlying slimes dam will eventually join the underlying weathered zone and migrate towards the streams and not downward into the mine workings.

The current impact on groundwater quality lies in the vicinity of the old underground workings. Mining at the new segments is therefore predicted to increase the TDS levels of groundwater pumped from underground. As this water will be pumped out as part of the dewatering, the impact of underground mining on groundwater quality will be minor.

Modelling results – Open Pit

The catchment boundary between quaternary catchments A21K and A22H transects the proposed pit some 450 m west of the eastern pit boundary. Excavation of the proposed pit will change the topography and as a result groundwater from both catchments will flow towards the pit centre in response to hydraulic gradient. Groundwater inflow into the

proposed pit will not only depend on the aquifer properties. The mine plan, mined area, depth and mining rate will also affect the groundwater inflow rates. Two scenarios were simulated analytically, based on the minimum and maximum groundwater level expected above the final pit floor level (50 mbgl), to predict the steady state groundwater inflow rate during mining.

The predicted inflow rates range between 1 027 and 1 684 m^3/d. When groundwater flows towards the pit (during mining) it inevitably dewaters and lowers the groundwater levels in the surrounding area. As the pits develop, the zone of influence of the groundwater level drawdown migrates and expands as the groundwater system attempts to retain a state of equilibrium.

The zone of influence due an inflow rate of 1 027 m^3/d is predicted to extend some 2.1 km from the pit centre. The worst case zone of influence is predicted to extend 2.5 km from the pit centre. The syenite dyke east of the pit is reportedly impermeable; hence the aquifers on the other side of the dyke are not expected to be influenced by mining of the proposed pit.

The properties and boreholes within the zone of influence belong to Lanxess Chrome Mine, therefore the dewatering is unlikely to affect external private groundwater users. As there are no external receptors within the zone of influence, the decrease in the volume of groundwater in natural storage due to mine dewatering is not foreseen to be significant.

8.4.1.1.5 Soils, Land Capability and Land Use (Please refer to detailed report in Appendix G)

This baseline study focused on the opencast operations and the associated infrastructure such as the dumps and the haul roads. This baseline report delineates soil types, determines land capability and current land use.

The area of the open pit operations is dominated by dark well-structured clayey soils (Arcadia and Valsrivier). These soils account for 373.77 ha (97.3%). The north-western portion of the open pit site contains shallow rocky soils (Mispah and Glenrosa) type soils, which accounts for 10.32 ha (2.7%). As seen in Figure 8-7.

The dominant land capability for the area is the Class III capability (373.77 ha), with the Class VIII capability (10.32 ha) in the north-western portion of the project area. Please refer to Table 8-11 below.

Figure 8-7: The soil forms present at the Lanxess opencast area

Table 8-11: Land capability classes

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	**Arable Land**
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W		LG	MG						**Grazing Land**
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									**Wildlife**

W - Wildlife **MG - Moderate Grazing** **MC - Moderate Cultivation**
F- Forestry **IG - Intensive Grazing** **IC - Intensive Cultivation**
LG - Light Grazing **LC - Light Cultivation** **VIC - Very Intensive Cultivation**

The dominant land use in the Lanxess open pit project area is that of cultivation (320.83 ha) as shown in the Land Use map (Appendix F), sorghum is being grown in these heavy clay soils.

The land use summary is as follows:

- Cultivated (320.77 ha);
- Grazing (13.04 ha);
- Natural (47.21 ha);
- Infrastructure (1.74 ha); and
- Disturbed (1.27 ha).

The dominant land capability for the open pit area is the Class III capability (373.77 ha), with the Class VIII capability (10.32 ha) in the north-western portion of the project area.

8.4.1.1.6 Visual (Please refer to detailed report in Appendix G)

The baseline study focused on the surface infrastructure and changes in topography as a result of the open pit operations. The expected visual impact of the proposed Lanxess activities was categorised based on the type of receiving environment and the type of development.

The proposed activities will have a high visibility and moderate visual exposure as it is will be visible from a large area and will be recognisable to the viewer. The proposed project has a moderate visual intrusion as it partially fits into the surroundings, but will be clearly

noticeable. Although the proposed project is an extension of an existing mine, its open pit, waste rock dump and topsoil stockpile cover a much larger area than the surface infrastructure of the existing Lanxess Chrome Mine and will therefore have an impact on the receiving environment. The receiving environment has a moderate visual absorption Capacity because there is partial screening by the topography.

Viewshed Model

This model was refined to a practical viewshed model (

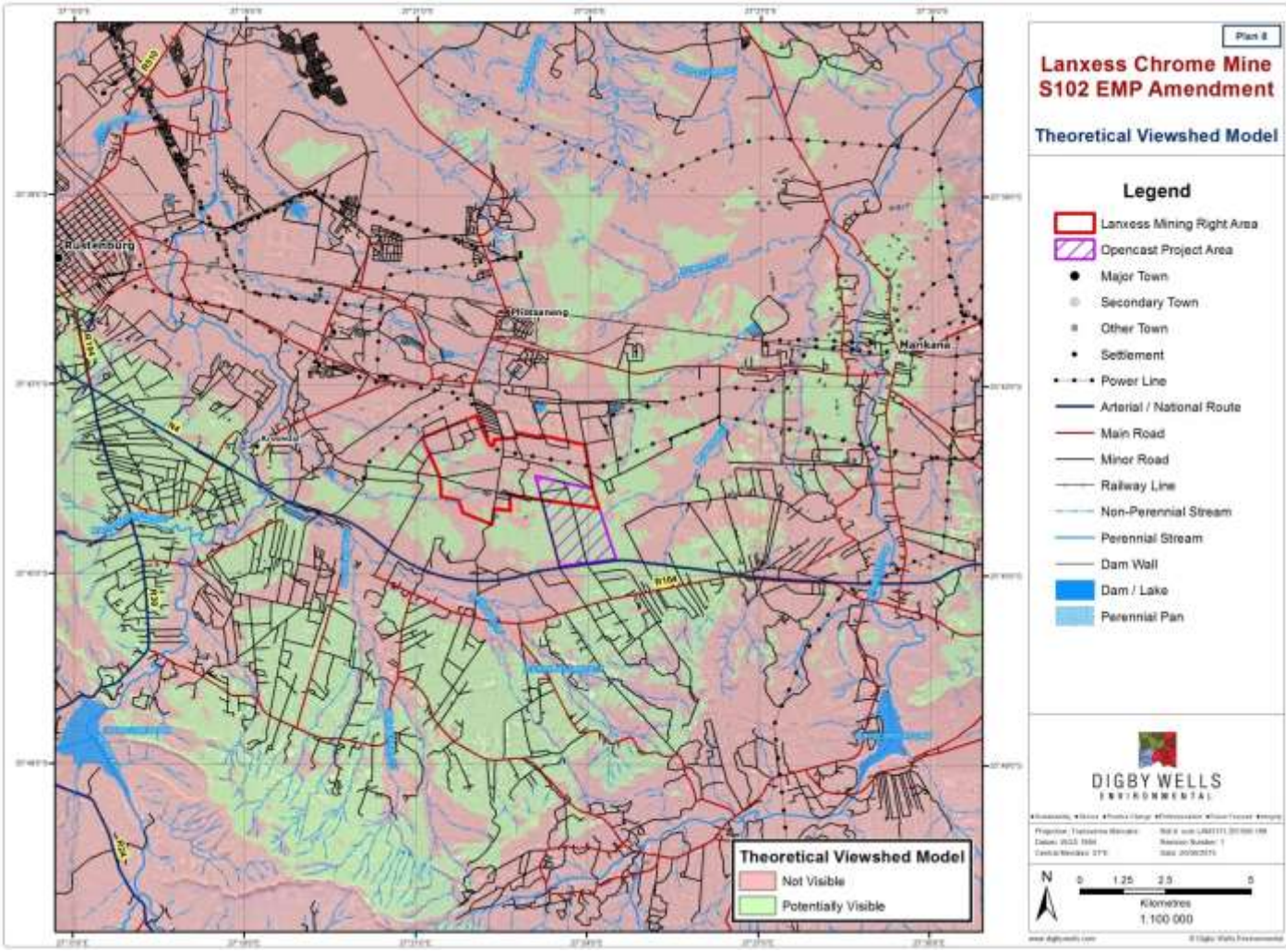

Figure 8-) with a buffer of 6 km around the proposed infrastructure and divided into areas that are likely to experience different categories of visual exposure.

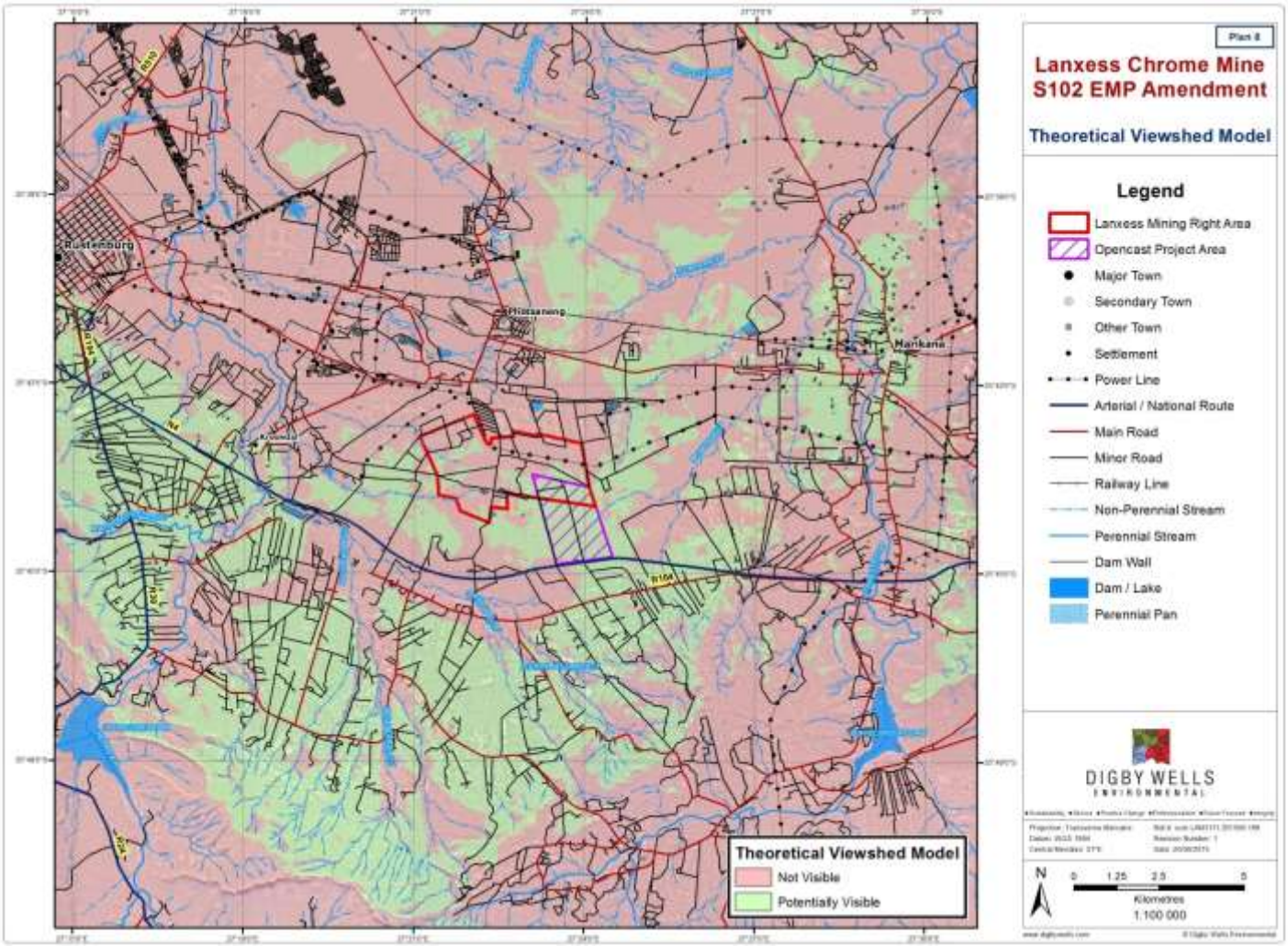

Figure 8-7: Theoretical Viewshed Model

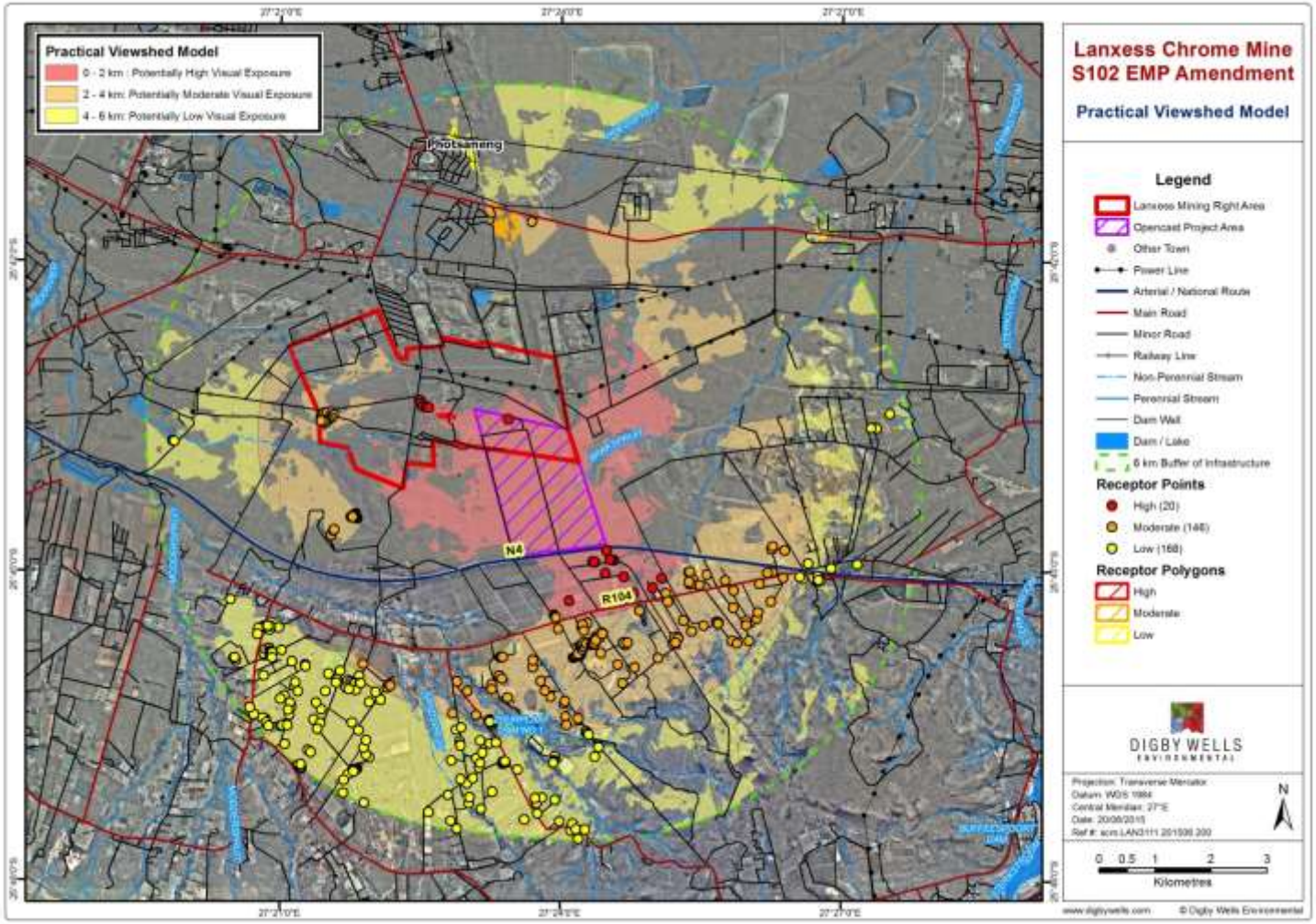

Figure 8-8: Practical Viewshed Model

8.4.1.1.7 Noise (Please refer to detailed report in Appendix G)

This report relates specifically to the noise impacts of the proposed open pit on the ambient noise climate of the area. The existing operations form part of the current ambient noise levels for the area. However the impact and mitigation measures include the existing and current operations.

The surrounding receptors are rural and suburban to the south, with numerous mines in the surrounding area as well.

The site criteria used for to determine the current ambient noise level at the nearest noise sensitive receptor to the proposed project were as follows:

- The location of the nearest rural receptors to the proposed project and subsequently the most likely to be impacted on by the proposed mining activities; and
- Locations that served as a suitable reference point for the measurement of ambient sound levels surrounding the proposed project area. The noise measurement locations cover a rural receptor (N1 and N2, as per Table 8-12). Please refer to Figure 8-8 for the locality of the sites.

Table 8-12: Noise measurement locations

Site ID	Location	Category of receiver	GPS coordinates
N1	Portion 15 of Waagfontein 340 JQ	Rural residential	25°44'53.97"S & 27°24'21.38"E Closest Receptor point
N2	Portion 16 of Waagfontein 340 JQ	Rural residential	25°44'59.81"S & 27°24'26.84"E Closest receptor point

Predictive modelling was performed for the proposed open pit mining activities through the use of modelling software. Estimates of the cumulative mining noise levels from the study were derived from the noise emissions from all the major noise-generating components and activities of the proposed project.

Table 8-13 indicates the noise power levels used in the model simulations. The sound power levels were derived from a number of previous studies.

Table 8-13: Sound power levels from main sources

Noise source	Sound power levels dB						
Octave band frequencies	*63Hz*	*125Hz*	*250Hz*	*500Hz*	*1000Hz*	*2000Hz*	*4000Hz*
Construction Phase							
Haul Truck	108	118	115	114	110	106	102
Excavators	113	117	107	108	106	101	95

Noise source	Sound power levels dB						
Octave band frequencies	*63Hz*	*125Hz*	*250Hz*	*500Hz*	*1000Hz*	*2000Hz*	*4000Hz*
Front end Loader	108	116	107	108	105	99	95
Dozer	110	122	113	114	110	108	104
Shovel	105	117	113	114	111	107	101

The noise dispersion modelling (Figure 8-8) software was used to assess whether the noise from the proposed open pit mining activities will impact on the relevant noise sensitive receivers, by comparing the predicted propagating noise levels with the current ambient baseline noise levels.

According to the National Noise Control Regulations, "disturbing noise" means 'a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more. The measured ambient sound level is summarised in Table 8-14 below.

Table 8-14: Results of baseline noise measurements

Sample ID	SANS 10103:2008 rating limit					
	Type of district	**Period**	**Acceptable rating level dBA**	**$L_{Areq,T}$ dBA**	**Maximum/Minimum dBA**	**Date**
N1	Rural	Daytime	45	58	89 / 42	14/01/2015
		Night time	35	54	72 / 33	14/01/2015
N2	Rural	Daytime	45	54	85 / 35	15/01/2015
		Night time	35	54	77 / 41	15/01/2015
	Indicates current $L_{Aeq,T}$ levels above either the daytime rating limit or the night time rating limit					

Based on the daytime results at N1, the existing ambient noise levels are above the SANS rating levels for the maximum allowable outdoor daytime limit (45 dBA) for ambient noise in rural districts. The average daytime noise level measured 58 dBA. The noise sources contributing to the ambient daytime levels at N1 are due mainly to the frequent vehicular activity on the N4 National Road (running 200 meters to the north of the property where the receptor is based see Figure 8-8).

Based on the daytime results at N2, the existing ambient noise levels are slightly above the SANS rating levels for the maximum allowable outdoor daytime limit (45 dBA) for ambient noise in rural districts. The average daytime noise level measured 54 dBA. The noise sources contributing to the ambient daytime levels at N2 are mainly frequent vehicle activity on the N4 (400 m to the north of the property where the receptor is based) as well as the infrequent vehicle activity on the R104 (600 m to the south).

Based on the night time results at N1and N2, the existing ambient noise levels are above the SANS rating levels for the maximum allowable outdoor night time limit (35 dBA) for ambient noise in rural districts. The average night time noise level measured 54dBA. The noise sources contributing to the ambient night time levels are mainly the vehicle activity on the N4 National Road as well as insect noise from the cricket family, *Gryllidae*.

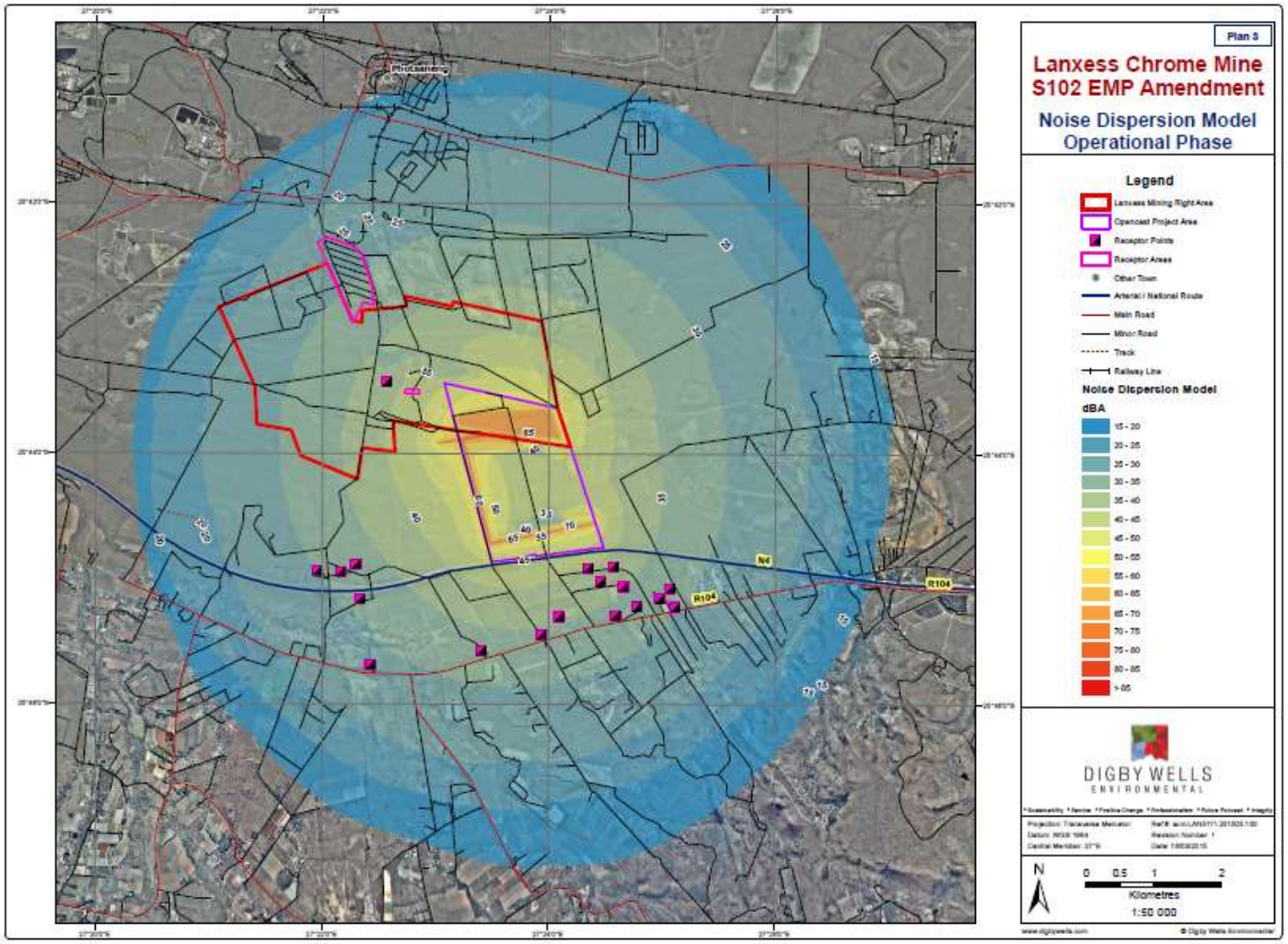

Figure 8-8: Noise dispersion model for the operational phase of the opencast

8.4.1.1.8 Heritage (Please refer to detailed report in Appendix G)

Due to the surface disturbance, the baseline study focused on the open pit operations and the associated infrastructure such as the dumps and the haul roads. It is not anticipated that the extension of the underground mining will have any further impact on the currently disturbed surface areas. If Lanxess proposes any additional surface infrastructure above these areas, further heritage studies are recommended.

A total of 22 heritage resources including Stone Age surface scatters, Iron Age stone-walled settlements, historical farmsteads and graves have been identified within 10 km from the LCM Project area (See Figure 8-11). These sites are discussed in the sections below.

Stone Age

A total of four Middle Stone Age surface scatters were identified through a review of relevant heritage reports, within 10 km of the LCM project area.

Weathered MSA tools were identified on the farm Kroondal 304JQ approximately 2 km from the LCM Project, during a survey conducted by van Schalkwyk and Pelser (2001); however no exact co-ordinates were supplied for this site.

Iron Age

Ceramic facies that can be found in the project area include Ntsuanatsatsi, Uitkomst and Rooiberg (See Table 8-15).

Table 8-15: Ceramic facies within the LCM project area

Facies	Period	Key Characteristics
Ntsuanatsatsi	1450 BC – 1650 BC	Broad stamping in the neck, stamped arcades on shoulder and appliqué
Uitkomst	1650 BC – 1820 BC	Stamped arcades, appliqué and blocks of parallel incisions, stamping and chord impressions
Rooiberg	1650 BC – 1750 BC	Stamped rim band, mixture of stamped and incised bands, arcades and triangles in the neck

The most visible indicator of Late Iron Age settlements is that of the stone walls. Stone-walled settlements in South Africa have been characterised and defined into two clusters and several types (see Table 8-16 below). Stone walled settlement types found within the project area are that of the Molokwane type settlement.

Figure 8-9: Example of double in-filled stone walls (Ft/006) identified to the north of the open pit project area

Table 8-16: Stone walled settlement types

Central Cattle Pattern			
Moor Park Cluster		**Ntsuanatsatsi Cluster**	
Moor Park	14th-16th Century	Type N	15th-17th Century
Melora	16th Century - ?	Badfontein	16th Century
Kwamaza	18th Century – Historic	Doornspruit	19th Century
		Klipriviersberg	19th Century
		Type V	19th Century
		Molokwane	19th Century
		Type Z	19th Century
		Type B	19th Century
		Tukela	19th Century

The majority of the Iron Age sites found in the areas surrounding the project area are that of the LIA (AD 1300 – 1840). A total of 14 Iron Age sites have been identified within 10 km of the LCM Project area. The majority of these sites are well preserved stone walled

settlements with cattle kraals, terraces, pottery, grinding stones. Additionally, an Iron Age engraving site was recorded 6.2 km from the project area depicting a settlement layout of a stone-walled settlement (See Appendix G).

Historical Period

A total of four (4) heritage sites relating to historical or recent times were recorded within 10 km of the project area, including the historic town of Kroondal. Foundations of an old farmstead were identified within 4.5 km of the open pit project area and two unmarked graves were located within 5 km of the project area. Graves are often associated with historical homesteads and can be found in close proximity.

Sensitive Areas

The sensitive areas within and immediately surrounding the open pit area are depicted below in Figure 8-10. These are areas which have been highlighted as high, medium and low sensitivity areas. These areas are estimations based on the cultural baseline profile and the scoping survey.

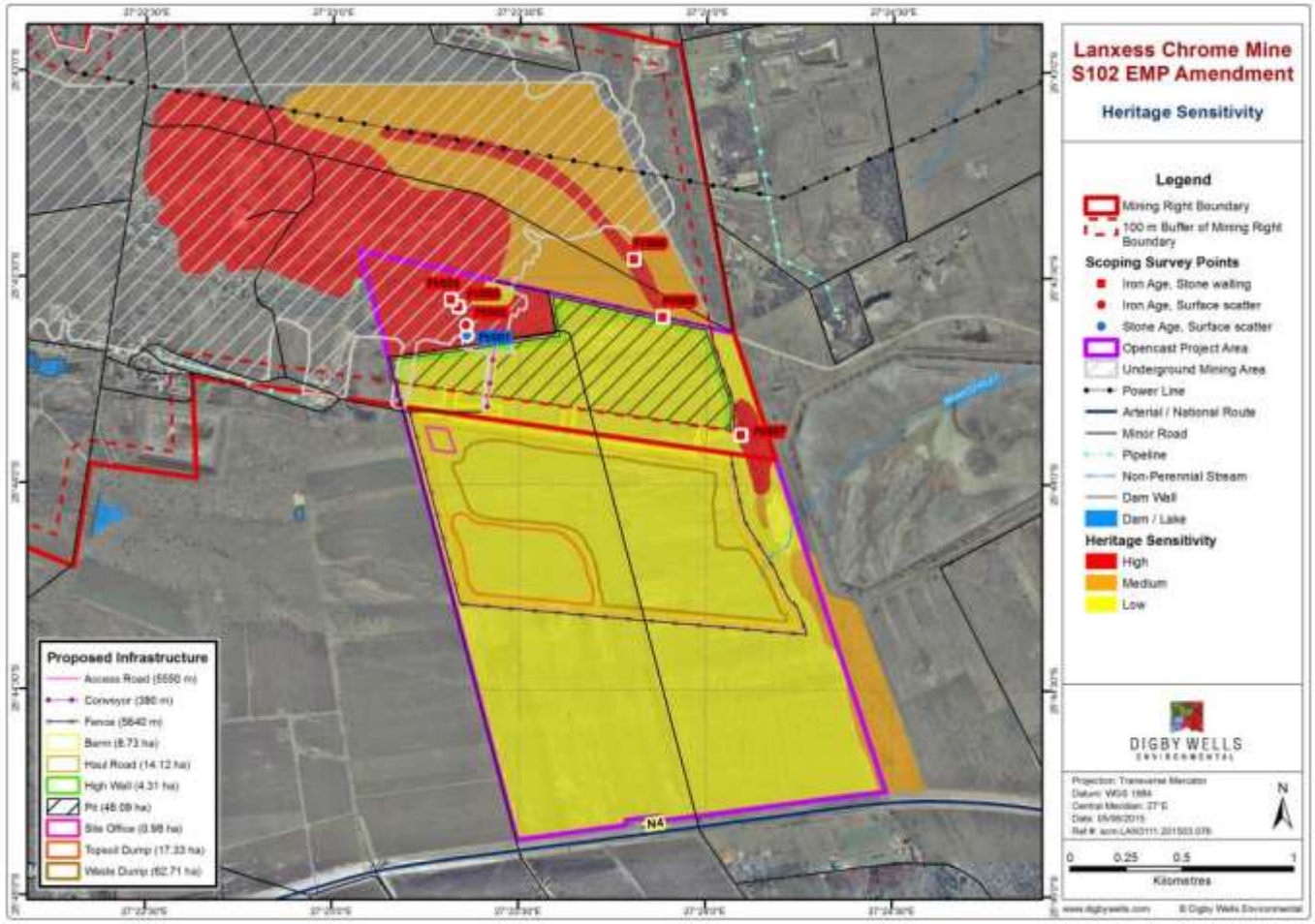

Figure 8-10: Heritage sensitivity for the opencast pit area

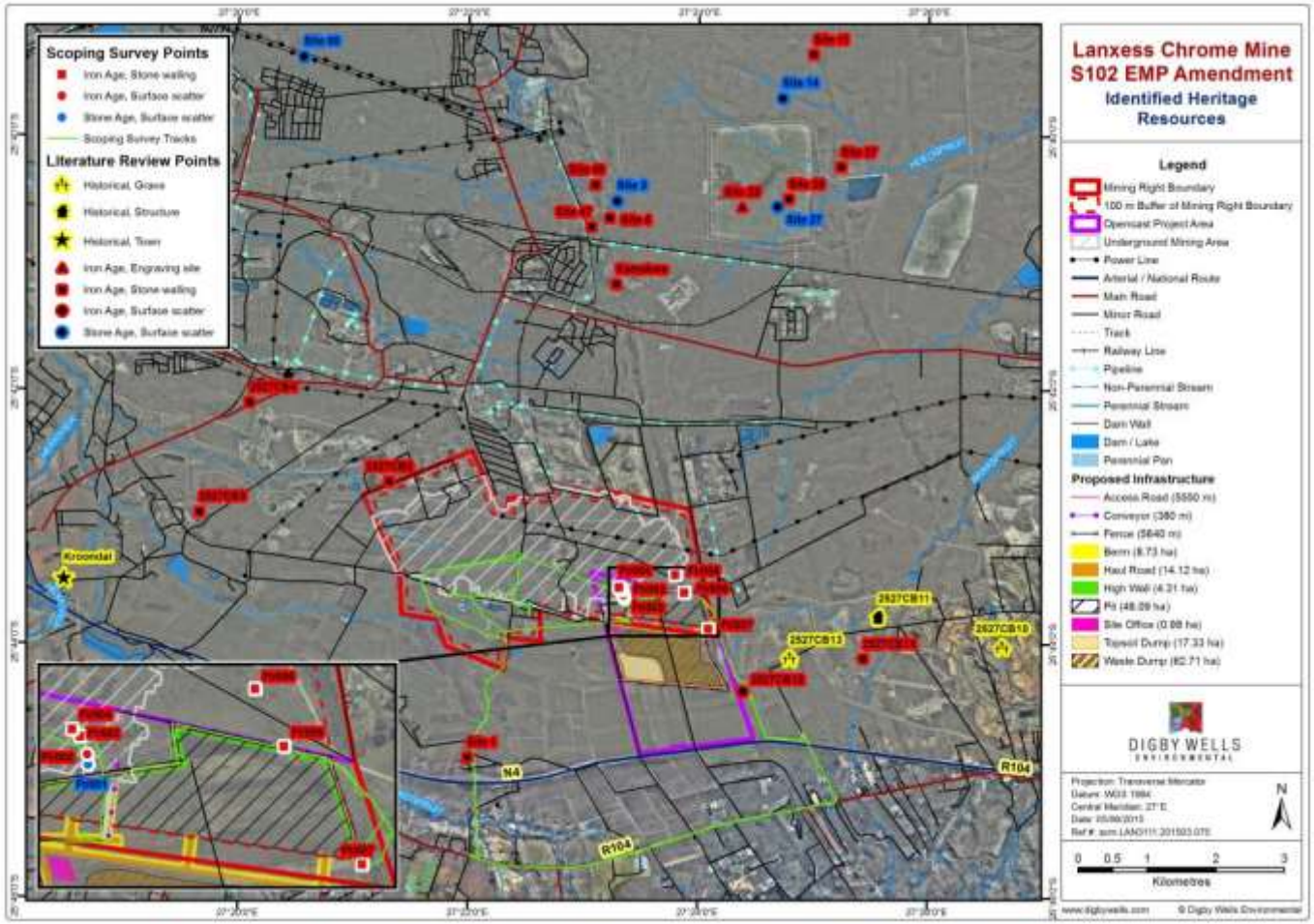

Figure 8-11: Identified heritage resources in the areas surrounding the LCM project

8.4.1.1.9 Socio-Economic Data

This section provides a brief overview of the socio-economic conditions of the Project area, including the Rustenburg Local Municipality (RLM) and a more targeted site-specific area. For the purposes of describing the site-specific socio-economic characteristics, the area has been defined as Ward 35, Ward 32 and Ward 33 of the RLM.

The Rustenburg Local Municipality is situated within the Bojanala District Municipality in the North West Province. Rustenburg is a large town situated at the foot of the Magaliesberg Mountain Range. Rustenburg (meaning 'town of rest' or 'resting place') was proclaimed a township in 1851. This large town is situated some 112 km north-west from both Johannesburg and Pretoria. It is the fastest growing municipality in South Africa and the most populous municipality in the North West province. The main Cities/Towns in the RLM include Hartbeesfontein, Phatsima, Rustenburg and Tlhabane. Rustenburg is linked to the above urban centres through an extensive regional road network. The most notable of these is the N4 freeway or Platinum Corridor, which links Rustenburg to Tshwane in the east and Zeerust to the west. The R24 links Rustenburg to Johannesburg in the south and the Pilanesberg to the north.

The total population of the Municipality is 549 575 people, comprising of 54% males and 46% females (StatsSA, 2011). This distribution could be attributed to labour migration to Rustenburg due to more males migrating to the city to obtain job opportunities.

The primary economic sectors within the RLM include mining and trade. The growth of these sectors has resulted in a decrease in the unemployment rate. The unemployment rate has steadily decreased over the period from 1996 to 2010/11. In comparison with the national statistics, the RLM has performed well. Approximately half of those with formal employment are employed in the mining sector (98 956 individuals), followed by trade (28 075) and community services (15 190). Prior to the growth of the mining industry, the wealth and development of Rustenburg was dependent on the agricultural sector. The area was considered a strong source for the supply of citrus products. Recently, however, increased interest on the platinum market has shifted economic reliance into the mining industry.

Local economic development is a key element in the growth of the municipality. Its growth rate requires regular and meaningful development of the region's economy. At the time of writing, the key projects taking place (or being planned) include the Rustenburg Rapid Transport system; development of the Rustenburg Airport; and Development of the Rustenburg International Convention Centre. Alongside the development initiatives, there are several investment opportunities within the municipality, including the Boitekong Mall and the extension of the Waterfall Mall.

The overall level of education has increased between 2001 and 2011, with fewer individuals having no schooling. Of the 352 511 people included in the statistics, 20 742 were noted to have no schooling (StatsSA, 2011).

Table 8-17 below highlights some of the socio-economic characteristics of the RLM as well as that of the site-specific area, based on data derived from Statistics SA (2011) and the RLM Integrated Development Plan (IDP) report.

Table 8-17: Socio-economic data for the RLM and the site-specific area

Baseline characteristics	Statistics	Local Municipality	Site-specific
Demographics	Total Population	549 575	3 3911
	Total No. of Households	197 488	1 1801
	Percentage Males	54%	61%
	Percentage Female	46%	39%
Education	No schooling	6%	7%
	Some primary	18%	22%
	Completed primary	8%	7%
	Some secondary	29%	40%
	Completed secondary	31%	22%
	Higher	8%	1%
Annual HH Income	No income	38%	35%
	R 1 - R 19 600	17%	30%
	R 19 601 - R 76 400	30%	25%
	R 76 401 - R 307 600	13%	8%
	R 307 601 or more	2%	1%
Housing	Formal	69%	65%
	Informal	30%	33%
	Traditional	1%	2%
Access to Electricity	Yes		66%
	No		34%

In terms of spatial development, land use and settlement patterns, there are several influencing factors. These include physical boundaries, such as the extent of Rustenburg City, the surrounding mines and associated road network (especially with the N4 substituting

the Swartruggens Road). In addition, the tribal lands act as socio-political boundaries. This often inhibits development based on supply and demand considerations. Rustenburg acts as sole CBD within the municipality and therefore provides employment opportunities, social amenities, economic activities and services to the entire municipality. Several segregated townships are located within the municipality; some as a result of the surrounding mining industry's housing programs. The greatest concentration thereof is located within 20 km of Rustenburg.

A number of development challenges on human settlement have emerged from the current municipal IDP process. The following land and housing issues were identified:

- Unpredictable housing subsidy allocation from the Department of Human Settlement, Public Safety and Liaison;
- Lack of suitable land for housing development;
- Illegal occupation of houses and vacant land;
- Evictions on private land; and

Lack of housing related infrastructure.

8.4.2 Description of the Current Land Uses

8.4.2.1 Current Land Use

The land use for the proposed underground project area is dominated by mining and industry with the proposed Kroondal area being a cultivated area.

The dominant land use in the Lanxess open pit project area is that of cultivation (320.83 ha), sorghum is being grown in these heavy clay soils.

The land use summary for that area is as follows (please refer to the land use map, Plan 6, under Appendix F):

- Cultivated (320.77 ha);
- Grazing (13.04 ha);
- Natural (47.21 ha);
- Infrastructure (1.74 ha); and
- Disturbed (1.27 ha).

8.4.2.2 Pre-mining Land Use

The pre-mining land use of the area to be mined is agriculture with dry land cultivation having taken place. The adjacent areas have poorer soils and were used for stock farming.

8.4.2.3 Historical Agricultural Production

Crops have been planted to on the eastern portion of the mineral rights area in the past, however it has not been used extensively in the last few years. The remaining land is used primarily for the mine infrastructure and housing facilities.

8.4.3 Description of Specific Environmental Features and Infrastructure on the Site

8.4.3.1 Environmental Features

The only noteworthy environmental features within the new development area include sensitive vegetation species. Please also refer to the Composite Map (Plan 5) attached in Appendix 4.

8.4.3.2 Current Infrastructure

The current infrastructure and associated activities on site is summarised in Table 5-3 in Section 5 of this report. Also refer to the Site Plan (Plans 3 a and 3 b) under Appendix 4.

8.4.4 Environmental and Current Land Use Map

Please refer to Appendix F for the current land use map (Plan 6) that also indicates environmental features.

8.5 Item 3(g)(v): Impacts and Risks Identified Including the Nature, Significance, Consequence, Extent, Duration and Probability

Section 8.6 describes in detail the methodology used to determine the significance, probability, and duration of the identified impacts.

Essentially the system is based on ordinal data where a number is used to represent a significance category. Ordinal data allows for an increase or decrease in the scoring to provide a relative indication which cannot be interpreted on a linear scale.

The methodology determines the environmental significance using the following equation:

Significance of environmental impact = Consequence X Probability

The results of the impacts determination for the various activities considered are set out below.

8.5.1 Potential Impacts on Air Quality (Please refer to detailed report in Appendix G)

8.5.1.1 Operational Phase

Activity/Impact	Crushing and screening				
Criteria	**Details / Discussion**				
Description of impact	During this stage, the ore from the underground operations and the open pit will be crushed to reduce the size. The dust generated encompasses TSP, PM_{10} and $PM_{2.5}$ (which may impact the human respiratory system due to the depth of penetration and the resultant interaction with human tissues).				
Mitigation required	To mitigate the impacts, the crusher should be enclosed to control the dust that is generated in the process. The application of water sprayers also helps to suppress generated dust thus reducing the impact.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	5	4	6	72
Post-Mitigation	2	5	3	5	50

Activity/Impact	Dumping of waste rock				
Criteria	**Details / Discussion**				
Description of impact	During this stage, waste rock brought to the surface and those from the open pit process is loaded onto 30 tonne tipper trucks and offloaded at the waste rock dumps. The loading and offloading process results in dust generated comprises TSP, PM_{10} and $PM_{2.5}$ (this fraction is causing health problem in the human respiratory system due to the depth of penetration and the resultant interaction with human tissues).				
Mitigation required	To mitigate the impacts of the loading and dumping process, the drop height when offloading must be lowered.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	4	6	66
Post-Mitigation	2	5	3	5	50

Activity/Impact	Stockpiling material				
Criteria	**Details / Discussion**				
Description of impact	Materials i.e. ROM, lumpy ore, crusher fines, HMS fines and stockpiles CO1, CO4 and CO6 are stored at their respective stockpiles. The various stockpiles thus represent sources of dust, with the subsequent erosion of dust that comprises TSP, PM_{10} and $PM_{2.5}$.				
Mitigation required	To mitigate the impacts of the stockpiling, water sprays on the stockpiles need to be utilised, use of wind breaks can be implemented near the respective stockpiles as these reduce anticipated dust impacts by 30%.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	5	3	5	55
Post-Mitigation	2	5	3	4	40

Activity/Impact	Transporting material				
Criteria	**Details / Discussion**				
Description of impact	This focuses on the use haul roads and the conveyance of chrome using conveyor belts. During this stage, materials are transported to the various stockpile using 3 tonne tipper trucks, which leads to the generation of fugitive dust comprising TSP, PM_{10} and $PM_{2.5}$.				
Mitigation required	To mitigate the impacts, vehicle speeds must be reduced that will, in turn, reduce emissions into the atmosphere. Water sprays on the road should be used frequently, keeping the road moist. Dust suppressants such as Dust-a-side can be applied on the haul roads. The construction of speed humps and enforcement of speed limits will also reduce the generation of dust.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	5	5	6	78
Post-Mitigation	2	5	3	6	60

8.5.1.2 Decommissioning Phase

Activity/Impact	Decommissioning

Criteria	Details / Discussion				
Description of impact	This activity entails the removal of buildings and foundations and rehabilitation of the voids and spreading of sub soil and topsoil. The reshaping and restructuring of the landscape though spreading of subsoil and topsoil will generate dust as soil is being transferred from one location to another. There is movement and transfer of soil to rehabilitate the void.				
Mitigation required	Spreading of soil must be performed on less windy days. The bare soil will be prone to erosion there is need to introduce surface vegetation cover to check erosion. Leaving the surface of the soil in a coarse condition reduces wind erosion and ultimately reduces the dust levels. Additional mitigation measures include keeping the soil moist using sprays or water tanks, using wind breaks. The best time to re-vegetate the area must be linked to the distribution and reliability of the rainfall.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	2	4	6	54
Post-Mitigation	3	2	3	5	40

8.5.2 Potential Impacts on Fauna and Flora (Please refer to detailed report in Appendix G)

8.5.2.1 Construction Phase

Activity/Impact	Site clearance and topsoil removal prior to the commencement of physical construction activities across the open pit area
Criteria	**Details / Discussion**
Description of impact	The almost complete degradation of natural vegetation and habitat for animal life has already taken place within the general environment due to current land use practices specifically agricultural. No natural vegetation remains within the project area, therefore none will be impacted on, except for the eastern edge of the open pit that will impact on medium high sensitivity Bushveld. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.
Mitigation required	The following mitigation measures are recommended: ■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the disturbed area to the minimum

Activity/Impact	Site clearance and topsoil removal prior to the commencement of physical construction activities across the open pit area				
Criteria	**Details / Discussion**				
	and within designated areas only. Re-vegetate open areas to limit erosion. ■ Avoid sensitive landscapes such as the Koppies that were encountered on site. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	3	4	40
Post-Mitigation	1	5	3	4	36

Activity/Impact	The construction of waste rock dumps
Criteria	**Details / Discussion**
Description of impact	No natural vegetation remains within the waste rock dump area, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.
Mitigation required	The following mitigation measures are recommended: ■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the rock dump within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these

Activity/Impact	The construction of waste rock dumps				
Criteria	**Details / Discussion**				
	soils are used.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	2	4	36
Post-Mitigation	1	5	2	4	32

Activity/Impact	The construction of topsoil stockpiles				
Criteria	**Details / Discussion**				
Description of impact	No natural vegetation remains within the topsoil stockpiles area, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.				
Mitigation required	The following mitigation measures are recommended: ■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the topsoil stockpiles within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	2	6	54
Post-Mitigation	1	5	1	6	42

Activity/Impact	The establishment of the initial boxcut and access ramps to the open pit mining areas				
Criteria	**Details / Discussion**				
Description of impact	No natural vegetation remains within the initial boxcut area, therefore none will be impacted on. The agricultural fields have a low sensitivity rating. The impact will be site specific in extent. The severity of the impact was determined to be low.				
Mitigation required	The following mitigation measures are recommended: ■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the initial boxcut within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	2	4	36
Post-Mitigation	1	5	2	4	32

Activity/Impact	The construction of haul roads on site
Criteria	**Details / Discussion**
Description of impact	No natural vegetation remains within the haul roads locations, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.
Mitigation required	The following mitigation measures are recommended: ■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the haul roads within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion.

Activity/Impact	The construction of haul roads on site				
Criteria	**Details / Discussion**				
	■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	2	4	36
Post-Mitigation	1	5	2	4	32

Activity/Impact	The construction of the access or service road				
Criteria	**Details / Discussion**				
Description of impact	No natural vegetation remains within the access or service road locations, therefore none will be impacted on. The agricultural fields have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.				
Mitigation required	The following mitigation measures are recommended: ■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the access and service roads within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance*

Activity/Impact	The construction of the access or service road				
Criteria	**Details / Discussion**				
					rating
Pre-Mitigation	2	5	2	6	54
Post-Mitigation	1	5	1	6	42

Activity/Impact	The construction of the hard park area				
Criteria	**Details / Discussion**				
Description of impact	No natural vegetation remains within the hard park area location, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.				
Mitigation required	The following mitigation measures are recommended: ■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the hard park area within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	2	6	54
Post-Mitigation	1	5	1	6	42

8.5.2.2 Operational Phase

Activity/Impact	Vehicular activity on haul roads, use of hall roads				
Criteria	**Details / Discussion**				
Description of impact	Vehicular activity could impact on fauna species in terms of road deaths; signs of road deaths were evident during field work. Furthermore, the vehicular activity will result in the creation of soil based dust which will increase the deposits these materials on plant leaves, blocking stomata and inhibiting evapotranspiration. Natural dust will be created from use of the haul road and ash dust will be created during transport by haul trucks. This will impact on the vegetation health and availability as food items as well as inhibit the ability of the plants units to provide ecological services.				
Mitigation required	The following mitigation measures are recommended: ■ Prevent excess dust creation that could inhibit plant growth by wetting of the haul roads to suppress dust creation as well as cover haul trucks to prevent dust emissions during transport. ■ To avoid animal deaths specific speed limits must be adhered to by all mining vehicles.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	3	5	50
Post-Mitigation	1	5	2	5	40

Activity/Impact	Concurrent replacement of overburden and topsoil and the re-vegetation of mined out strips
Criteria	**Details / Discussion**
Description of impact	This may be considered to be a positive impact if implemented properly over time. The replacement of overburden and topsoil throughout the concurrent rehabilitation during the operational phase may result in the reduction of available space for alien invasive species, soil erosion and soil compaction, associated with top soil storage areas. This activity will create favourable habitat for indigenous plant species, and promote rehabilitation efforts, if completed correctly.
Mitigation required	The following mitigation measures are recommended: ■ Reduce areas available for alien infestation by restoring disturbed areas to natural habitat.

Activity/Impact	Concurrent replacement of overburden and topsoil and the re-vegetation of mined out strips				
Criteria	**Details / Discussion**				
	■ Implementation of an alien invasive management program is imperative to reduce the risk of these plant species infesting the mine area.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Enhancement	1	2	2	2	10
Post-Enhancement	4	5	4	4	39

8.5.2.3 Decommissioning Phase

Activity/Impact	Removal of infrastructure				
Criteria	**Details / Discussion**				
Description of impact	Of concern here is the creation of favourable habitat for fast growing invasive species and ground compaction. Also of concern are the possible spillages from infrastructure holding hazardous material. The demolition of infrastructure may require vehicles making use of non-designated areas, special care must be taken not to destroy rehabilitated areas.				
Mitigation required	The following mitigation measures are recommended: ■ Avoid spillage of hazardous materials, thereby protecting vegetation and soil. The correct and careful handling of the infrastructure housing pollutants and toxicants to prevent spillages and leaks. ■ Avoid destruction of vegetation, the creation of favourable habitat for fast growing invasive plants and ground compaction, by forcing vehicles to make use of existing roads and designated areas. Avoid rehabilitated and natural habitat areas as far as possible. ■ The implemented alien invasive control program must be adhered to carefully.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	2	4	4	32
Post-Mitigation	2	2	3	4	28

Activity/Impact	Final replacement of overburden and topsoil and the establishment of vegetation on the final open cast void. Overburden will be backfilled into the final void and compacted. Subsequently, topsoil will placed and the area vegetated				
Criteria	**Details / Discussion**				
Description of impact	This may be considered to be a positive impact if implemented properly, and managed over time. The replacement of overburden and topsoil throughout the life of mine as well as the final replacement during the decommissioning phase may result in the restoration of the natural vegetation.				
Mitigation required	The following mitigation measures are recommended: ■ The footprint of the area disturbed by the mining operation will have topsoil and overburden replaced to restore the vegetation cover, through proper rehabilitation. ■ Limit the erosion potential of exposed areas by re-vegetation. ■ Re-vegetated areas will form seepage areas which will help aid infiltration.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Enhancement	1	1	2	2	8
Post-Enhancement	4	5	4	5	65

8.5.2.4 Closure/Post Closure Phase

Activity/Impact	Post-closure monitoring and rehabilitation				
Criteria	**Details / Discussion**				
Description of impact	This activity will commence only after closure has taken place, furthermore this activity will be on-going after operations in the area has stopped.				
Mitigation required	The following mitigation measures are recommended: ■ Direct rehabilitation efforts by ensuring correct measures are employed for a variety of rehabilitation projects. ■ Avoid erosion, alien invasive species establishment, by monitoring rehab outcome to ensure open areas are eliminated.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance*

Activity/Impact	Post-closure monitoring and rehabilitation				
Criteria	**Details / Discussion**				
					rating
Pre-Enhancement	1	1	2	2	8
Post-Enhancement	4	5	4	5	65

8.5.3 Potential Impacts on Surface Water (Please refer to detailed report in Appendix G)

8.5.3.1 Construction Phase

Activity/Impact	Impacts on surface water during construction phase				
Criteria	**Details / Discussion**				
Description of impact	The following impacts are anticipated: ■ Increase in turbidity of surface water runoff during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles; and ■ Impacts on surface water quality as a result of accidental spillages of hazardous substances (hydrocarbons) from construction vehicles used during site clearing and grubbing.				
Mitigation required	The following mitigation measures are recommended: ■ Clearing of vegetation should be limited to the project site, and the use of existing access roads should be prioritized so as to limit the construction of new access roads in these areas; ■ The construction phase should be limited to the dry months of the year (May-October) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing and grubbing; ■ The removed topsoil should be covered or vegetated as soon as possible to prevent sediment erosion; ■ Haul roads need to be well compacted to avoid erosion of the soil into the stream.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*

Activity/Impact	Impacts on surface water during construction phase				
Criteria	**Details / Discussion**				
Pre-Mitigation	3	2	4	9	54
Post-Mitigation	2	2	3	7	28

8.5.3.2 Operational Phase

Activity/Impact	Impacts on surface water during operational phase
Criteria	**Details / Discussion**
Description of impact	The following impacts are anticipated: ■ Unconfined stormwater runoff from dirty water areas in the mine have the potential to contaminate the natural water resources; ■ Diversion of clean water runoff upstream of the mine dirty water area Water upstream of the mine area is considered clean and will have to be separated from the dirty water area. ■ Blasting during the operational phase will release ammonium nitrates from the explosive residues. This chemical will contaminate the water in the pit and may potentially contaminate the streams if water is discharged into the natural environment. Nitrates and ammonia from blasting residues, can lead to eutrophication (nutrient enrichment) of water bodies. They may also be converted into toxic nitrites. Ammonia (NH_3 as opposed to NH_4^+) is highly toxic to fish and many aquatic organisms at even low (µg/l) concentrations; ■ Impacts on surface water quality as a result of mobilized hazardous substances (hydrocarbons) from trucks and machinery during operation of mine; and ■ Inadequate storm water management and soil stabilisation measures in cleared areas could lead to erosion that may result in siltation of nearby watercourses.
Mitigation required	The following mitigation measures are recommended: ■ Dust suppression measures should be implemented to prevent the spread of dust and erosion of loose materials; ■ The topsoil stockpiles should be vegetated as soon as possible to prevent dust, erosion and siltation of the water bodies; ■ The storage facilities for fuel, lubricant and explosives must comprise a hard standing area (paved or concrete surface) and be roofed and bunded. This will prevent mobilisation of leaked hazardous substances. Emergency spillage response plan should in place and accessible to the responsible

Activity/Impact	Impacts on surface water during operational phase				
Criteria	**Details / Discussion**				
	monitoring team; ■ All the water being pumped from the pit should be stored in the existing pollution control dams (PCD's) for re-use on the mine so as to prevent unnecessary discharge into the environment; ■ Based on Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the mine must be diverted away and discharged to the nearby watercourse or environment; The clean water diversion must be sized to accommodate the 1:50 year storm event. ■ Should the contained water be more than the water use requirement, the BPGs advises that the water be recycled or as the last resort be treated to acceptable levels and discharged either to the natural environment or be supplied to other industries as a lower grade of water; and ■ As the open pit mining progresses, continuous rehabilitation should be implemented by backfilling the voids. This will ensure that the dirty water footprint area is decreased so that the volume of dirty water runoff required to be pumped out of the pit is significantly reduced.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	5	4	5	60
Post-Mitigation	1	4	3	4	32

8.5.3.3 Decommissioning Phase

Activity/Impact	Impacts on surface water during decommissioning phase
Criteria	**Details / Discussion**
Description of impact	The following impacts are anticipated: ■ Mobilization of leaked/spilled contaminants (hazardous and hydrocarbon containing material) from trucks and machinery during decommissioning phase could have an impact on the quality of water in the nearby streams; and ■ Backfilling of open cast voids and re-vegetation of the rehabilitated area will have a positive impact on the quantity of water reporting to the rivers as the natural drainage pattern i.e. runoff, will be restored.

Activity/Impact	Impacts on surface water during decommissioning phase				
Criteria	**Details / Discussion**				
Mitigation required	The following mitigation measures are recommended: ■ Use of accredited contractors for removal or demolition of infrastructures should be ensured; ■ The backfilled areas should be vegetated as soon as possible to prevent dust and siltation of the water bodies; ■ Inspection of the rehabilitated areas need to be undertaken to ensure that the surface profile encourages natural drainage, such that no ponding or standing water occurs after a rainfall event. ■ Where rehabilitation (grass seeding of topsoil cover) is not effective, sedimentation should be mitigated by installing silt traps at areas where the surface runoff enters the surface water resources; and ■ Water quality monitoring should continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	5	4	4	48
Post-Mitigation	2	2	3	3	21

8.5.3.4 Closure/Post Closure Phase

Activity/Impact	Impacts on surface water during closure/post closure phase				
Criteria	**Details / Discussion**				
Description of impact	Decant of poor quality groundwater from the mining areas may have a negative impact on the surrounding surface water resources.				
Mitigation required	Surface water quality monitoring should continue to ensure that there is no impact on the surrounding water resources emanating from the mine area.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	2	4	6	54
Post-Mitigation	2	2	3	4	28

8.5.4 Potential Impacts on the Geohydrology (Please refer to detailed report in Appendix G)

8.5.4.1 Construction Phase – Underground Mining

Activity/Impact	The establishment of the underground access shaft				
Criteria	**Details / Discussion**				
Description of impact	During the construction phase, the establishment of the underground access shaft could have an impact on the groundwater system. The establishment of the shaft requires blasting which may negatively affect the groundwater quality if significant amounts of explosive are spilled or incompletely detonated.				
Mitigation required	Impacts from mine dewatering during the construction phase are unlikely. The following mitigation and management measures are proposed to keep the impact to a minimum if it occurs: ■ Undertake groundwater intrusive investigation around the shaft to optimise the position of the shaft and associated infrastructure to avoid major water bearing features; ■ Handle and store blasting material according to manufacturing requirements; ■ Establish the depth to groundwater table prior to construction; ■ Grout or pump out any significant inflow of groundwater during shaft construction to ensure a dry and safe working environment; ■ Depending on the quality of the groundwater, discharge, store or recycle as appropriate; and ■ Monitor quality of mine water.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	3	3	3	24
Post-Mitigation	1	2	2	2	18

8.5.4.2 Operational Phase – Underground Mining

Activity/Impact	Mine dewatering – underground mining (new segments)
Criteria	**Details / Discussion**
Description of impact	In general, significant influxes of groundwater can occur during underground mining. This influx inevitably dewaters and lowers groundwater levels in the surrounding mining area. As more areas are mined, the zone of influence of the groundwater level drawdown migrates and expands as the groundwater system attempts to retain

Activity/Impact	Mine dewatering – underground mining (new segments)				
Criteria	**Details / Discussion**				
	a state of equilibrium.				
Mitigation required	The following mitigation measures are to be put in place: ■ Dewater very closely to the active mining face; ■ Manage groundwater abstraction rates and volumes in accordance with borehole sustainable yields; ■ Monitor groundwater abstractions to ensure that the aquifer from which water is abstracted is not over-exploited; ■ Pump excess underground water to appropriate surface storage facility accordingly to manage and minimise the water quality impacts. When required by the process plant, the abstracted water can be discharged into the return water dam; ■ Reuse water as far as possible. An off-take can be installed from the reservoir to the vehicle maintenance bay for use in dust suppression activities and general usage at the bay. However, for dust suppression it is good practice to first use marginal mine water or grey water before using pristine groundwater; and ■ Monitor water influx, water stored, water removed; and water levels in the underground mine and groundwater levels in the perimeter of the underground mine.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	5	4	4	48
Post-Mitigation	2	5	3	3	30

Activity/Impact	Mine water contamination
Criteria	**Details / Discussion**
Description of impact	The current impact on groundwater quality lies in the vicinity of the old underground workings. Mining at the new segments is therefore predicted to increase the TDS levels of groundwater pumped from underground.
Mitigation required	The following mitigation measures are to be put in place: ■ The mine water management measures recommended during construction

Activity/Impact	Mine water contamination				
Criteria	**Details / Discussion**				
	phase should continue during the operational phase; ■ It is recommended that abstraction from boreholes that are close to the mine workings should be avoided so that contaminants will not migrate away from the mine, towards the abstraction boreholes; ■ Monthly or quarterly monitoring of groundwater qualities and water levels are recommended (particularly down gradient of the mine site) with continuous refining and updating of the monitoring network based on the results obtained; ■ Annual audits of monitoring and management systems should be conducted by independent environmental consultants; and ■ With the application of the above-stated mitigation plans, the impact of the contaminant migration during construction phase can be lowered to negligible.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	5	4	5	60
Post-Mitigation	2	5	3	3	30

8.5.4.3 Closure/Post Closure Phase – Underground Mining

Activity/Impact	Mine decant
Criteria	**Details / Discussion**
Description of impact	After the operational phase, the underground mine will be left to flood. Water level rise and inflows during the rebound period in any one compartment will be a function of only two features: ■ The total recharge to the compartment (i.e. the sum of rain-fed recharge and any head-dependent inflows from adjoining aquifers, and/or other compartment); and ■ The distribution of storage capacity within the compartment.
Mitigation required	The following mitigation measures are to be put in place: ■ Monitor water level rise and apply stage curves to assess the rate of flooding; ■ Seal mine shafts to prevent surface water from flowing into the defunct underground voids;

Activity/Impact	Mine decant				
Criteria	**Details / Discussion**				
	■ Seal all boreholes that connects the mine void to surface; ■ Monitor groundwater levels in boreholes in the surrounding aquifers to assess groundwater table responses; and ■ Groundwater monitoring should continue up to 5 years after closure.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	6	5	4	68
Post-Mitigation	2	6	3	3	33

Activity/Impact	Mine water contamination				
Criteria	**Details / Discussion**				
Description of impact	Contaminant migration away from the mine voids can only be induced by groundwater abstractions within the capture zone of the mine workings, and if decant occurs.				
Mitigation required	The following mitigation measures are to be put in place: ■ No abstraction boreholes should be drilled in a 3 km radius from the underground workings in the post closure environment; ■ Perform effective rehabilitation and closure of redundant facilities through material placing and shaping, capping with appropriate capping liners and re-vegetation to prevent post closure infiltration through sources; and ■ Consider groundwater plume remediation only if post closure monitoring indicates a persistent pollution plume at unacceptable concentrations.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	6	5	4	56
Post-Mitigation	2	6	3	3	33

8.5.4.4 Construction Phase – Open Pit Mining

Activity/Impact	Mine dewatering

Criteria	Details / Discussion				
Description of impact	Excavation of the proposed pit will change the topography. As a result groundwater from both catchments will flow towards the pit centre in response to hydraulic gradient.				
Mitigation required	Although the impacts due to mine dewatering during construction phase are unlikely, the following mitigation and management measures are proposed to keep the impact to a minimum if it occurs; ■ Establish the depth to groundwater table prior to construction; ■ Minimise penetration into the groundwater table; ■ If groundwater table is to be penetrated to significant depth, dewater aquifer prior to excavations; ■ Depending on the quality of the groundwater, discharge, store or recycle as appropriate; and ■ Obtain permission from regulating authority.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	3	3	3	24
Post-Mitigation	1	3	2	2	18

Activity/Impact	Mine water contamination
Criteria	**Details / Discussion**
Description of impact	Site clearing and removal of topsoil may lead to puddles of surface water in the cleared areas during the wet season and potentially lead to increased infiltration to the weathered aquifers. Oil or fuel spillages from site machinery may collect in the soils. During rainfall events, hydrocarbon compounds from oil and fuel in the soils may migrate to the aquifers with water infiltrating through these polluted areas.
Mitigation required	The following mitigation measures are recommended: ■ Implement and train drivers to adhere to traffic rules; ■ Implement a vehicle maintenance schedule; ■ Install oil collection pans under vehicles; ■ Handle and store blasting material according to manufacturing requirements;

Activity/Impact	Mine water contamination				
Criteria	**Details / Discussion**				
	■ Minimise external contamination sources in the pit (diesel, oils, chemicals) as far as possible to ensure that groundwater flowing into the mine is contaminated; and ■ Monitor quality of mine water.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	3	3	3	24
Post-Mitigation	1	3	2	2	20

8.5.4.5 Operational Phase – Open Pit Mining

Activity/Impact	Mine dewatering
Criteria	**Details / Discussion**
Description of impact	The predicted inflow rates range between 1 027 and 1 684 m^3/d. When groundwater flows towards the pit (during mining) it inevitably dewaters and lowers the groundwater levels in the surrounding area. As the pits develop, the zone of influence of the groundwater level drawdown migrates and expands as the groundwater system attempts to retain a state of equilibrium.
Mitigation required	The following mitigation measures are recommended: ■ Minimise groundwater influx into pit through optimisation of mining layout to minimise structural disturbance; ■ Dewater aquifer prior to further excavations. Dewatering is more effective when operated very closely to the active mining face; ■ Manage groundwater abstraction rates and volumes in accordance with borehole sustainable yields; ■ Perform monitored groundwater abstractions to ensure that the aquifer from which water is abstracted is not over-exploited; ■ Pump excess pit water to appropriate surface storage facility according to water quality. When required by the process plant the abstracted water can be discharged into the return water dam; ■ Reuse water as far as possible. An off-take can be installed from the reservoir to the vehicle maintenance bay for use in dust suppression activities and general usage at the bay. However, for dust suppression it is

Activity/Impact	Mine dewatering				
Criteria	**Details / Discussion**				
	good practice to first use "marginal" mine water before using pristine groundwater; and ■ Monitor water influx, water stored, water removed; water level in the pit and groundwater levels in the perimeter of the pit.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	2	5	3	3	30
Post-Mitigation	1	5	2	2	22

Activity/Impact	Mine water contamination				
Criteria	**Details / Discussion**				
Description of impact	Any seepage emanating from the adjacent waste rock dump will eventually join the underlying saturated zone and migrate towards the pit due to hydraulic gradient.				
Mitigation required	The following mitigation measures are recommended: ■ The mine water management measures recommended during construction phase should continue during the operational phase; ■ It is recommended that abstraction from boreholes that are close to the mine workings should be avoided so that contaminants will not migrate away from the mine, towards the abstraction boreholes; ■ Divert surface flows away from the open pit areas through channels, drains and culverts; ■ Monitoring of groundwater quality and water levels is recommended (particularly down gradient of the mine site) with continuous refining and updating of the monitoring network based on the results obtained; ■ Annual audits of monitoring and management systems should be conducted by independent environmental consultants; and ■ With the application of the above-stated mitigation plans, the impact of the contaminant migration during construction phase can be lowered to Negligible.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*

Activity/Impact	Mine water contamination				
Criteria	**Details / Discussion**				
Pre-Mitigation	3	5	5	4	40
Post-Mitigation	2	5	3	3	30

8.5.4.6 Closure/Post Closure Phase – Open Pit Mining

Activity/Impact	Mine decant				
Criteria	**Details / Discussion**				
Description of impact	After the operational phase all the pit will be left open. The groundwater table will rise again to its pre-mining position and water will accumulate in the pits due to cessation of dewatering. A pit lake will develop. Groundwater flow will be directed to towards the pit lake as evaporation from the pit water causes it to act as a groundwater sink. In addition to precipitation, surface water runoff from the surrounding area will flow to the pit and add to the rise of the pit lakes.				
Mitigation required	The following mitigation measures are recommended: ■ Monitor pit water level rise and apply stage curves to assess the rate of flooding; ■ Seal mine shafts to prevent surface water from flowing into the defunct underground voids; ■ Monitor groundwater level elevation in boreholes in the surrounding aquifer to assess groundwater table responses; and Groundwater monitoring should continue up to 5 years after closure.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	6	5	2	30
Post-Mitigation	2	6	4	1	24

Activity/Impact	Mine water contamination
Criteria	**Details / Discussion**
Description of	The final open pit, the waste dumps and old underground workings will be the major

Activity/Impact	Mine water contamination				
Criteria	**Details / Discussion**				
impact	contamination sources in the post closure environment. The quality of groundwater in the post-closure environment will depend on background groundwater quality, the quality and quantity of surface water flowing into the pit and the geochemical processes that occur on the walls of the pit, above and below the pit lake.				
Mitigation required	The following mitigation measures are recommended: ■ No abstraction boreholes should be drilled in 2.5 km radius from the pit in the post closure environment; ■ Perform effective rehabilitation and closure of redundant facilities through material placing and shaping, capping with appropriate capping liners and revegetation to prevent post closure infiltration through sources; and ■ Consider groundwater plume remediation only if post closure monitoring indicates a persistent pollution plume at unacceptable concentrations.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significance rating*
Pre-Mitigation	3	6	5	4	56
Post-Mitigation	2	6	3	3	33

8.5.5 Potential Impacts on Soils, Land Capability and Land Use (Please refer to detailed report in Appendix G)

8.5.5.1 Construction Phase

Activity/Impact	Loss of topsoil as a resource – open pit
Criteria	**Details / Discussion**
Description of impact	When vegetation is cleared and the topsoil is stripped, the soils natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Construction vehicles driving on these soils cause compaction reduces the soils ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource

Activity/Impact	Loss of topsoil as a resource – open pit
Criteria	**Details / Discussion**
	through alterations and removal.
Mitigation required	■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks); ■ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ■ The topsoil 0.3 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.7 – 0.9 m thick will then be stripped and stockpiled separately; ■ Soils to be stripped according to the rehabilitation soil management plan and stockpiled accordingly; ■ Foundation excavated soil should also be stockpiled; ■ Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for macro nutrients and pH; ■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; ■ Prevent unauthorised borrowing of stockpiled soil; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ■ Soils will be stripped using the delineated soil types as guide. Yellow and red soils may be stripped together. Wetland soils (if allowed) should be stripped and stockpiled separately but also in the order topsoil (0.3 m) then subsoil separately; and ■ Access should be limited to prevent any unnecessary compaction from occurring.

Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	3	5	5	7	91
Post-Mitigation	2	5	3	3	30

Activity/Impact	Hydrocarbon pollution				
Criteria	**Details / Discussion**				
Description of impact	When Hydrocarbons are spilled on a soil surface the soil becomes contaminated and therefor becomes toxic for plant growth.				
Mitigation required	■ Prevent any spills from occurring; ■ If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities; ■ All vehicles are to be serviced in a correctly bunded area or at an off-site location; and ■ Leaking vehicles will have drip trays place under them where the leak is occurring.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	1	7	7	6	90
Post-Mitigation	1	1	7	5	45

Activity/Impact	Loss of land capability				
Criteria	**Details / Discussion**				
Description of impact	Removal of soil layers will impact on the land capability because vegetation can no longer be supported.				
Mitigation required	■ No land capability mitigation is possible during the construction and operational phases because the land use is changed from agriculture to open pit; and ■ Mitigation of land capability post mining is required through legislation through land rehabilitation.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	1	5	6	7	84
Post-Mitigation	1	5	5	6	66

8.5.5.2 Operational Phase

Activity/Impact	Loss of stockpiled topsoil as a resource
Criteria	**Details / Discussion**

Activity/Impact	Loss of stockpiled topsoil as a resource				
Criteria	**Details / Discussion**				
Description of impact	Topsoil losses can occur during the operational phases as a result of rain water runoff and wind erosion, especially from roads and soil stockpiles where steep slopes are present.				
Mitigation required	■ Stockpiles are to be maintained in a fertile, vegetated, and erosion free state; ■ Stockpiles are to be clearly demarcated; ■ Ensure proper storm water management designs are in place; ■ Access routes are to be kept to a minimum as to reduce any unnecessary compaction from occurring; ■ If erosion occurs, corrective actions must be taken to minimize any further erosion from taking place; and ■ Unauthorised borrowing of stockpiled soil materials should be prevented.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	3	5	5	7	91
Post-Mitigation	2	5	3	3	30

Activity/Impact	Hydrocarbon pollution				
Criteria	**Details / Discussion**				
Description of impact	Hydrocarbon spills can impact soil quality.				
Mitigation required	■ Prevent any spills from occurring; ■ If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities; ■ All vehicles are to be serviced in a correctly bunded areas or at an off-site location; and ■ Leaking vehicles will have drip trays place under them where the leak is occurring.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	1	7	7	6	90
Post-Mitigation	1	1	7	5	45

Activity/Impact	Loss of land use and land capability				
Criteria	**Details / Discussion**				
Description of impact	Impact on the rehabilitation of soil, soil quality and land capability. Backfilling of soil layers will impact on the land capability by restoring the land capability to some extent because vegetation will be supported and therefore returned to the planned post mining land capability such as arable and or grazing.				
Mitigation required	■ Mitigation is possible because the land use is changed from mining back to agriculture as follows: ■ The spoil should be shaped taking the pre-mining landscape into consideration; ■ The designed post mining landforms should be modelled to establish the post mining landscape stability by using a combination of GIS and erosion modelling techniques by a suitably qualified expert using site specific soil quality data; ■ The soil layers should be put back in the reverse order of stripping namely subsoil first then topsoil; ■ The yellow and red soils should be replaced in upland landscape positions; ■ Wetland soils should be put back in the reverse order of stripping; ■ Wetland soils should be placed in lower landscape positions; ■ The soil quality should be investigated prior to establishing vegetation on the rehabilitated soil through representative sampling and laboratory analysis; ■ The analytical data should be evaluated by a suitably qualified expert and vegetation fertility and or soil acidity problems should be corrected prior to vegetation establishment; ■ Clear targets incorporating medium to long term post mining land capability influencing land use, should be part of a potentially successful closure plan; and ■ From a national food security viewpoint, ways need to be found of rendering land rehabilitated to arable standards suitable for the economic production of cash crops.				
Parameters	Spatial	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	1	5	6	7	84
Post-Mitigation	1	5	4	6	60

8.5.6 Potential Visual Impacts (Please refer to detailed report in Appendix G)

8.5.6.1 Construction Phase

Activity/Impact	The transportation of construction material to the project site via national, provincial and local roads				
Criteria	**Details / Discussion**				
Description of Impact	The transportation of construction material will have a negative visual impact on the receiving environment. Vehicular activity and the resulting dust will draw attention to the project area. These visual impacts are temporary and will only occur during the construction phase.				
Mitigation Required	The following mitigation measures are recommended: ■ Roads should be wetted frequently by means of a water bowser to suppress dust; and ■ Vehicles must be roadworthy and obey the recommended speed limits at all times.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	2	2	4	28
Post-Mitigation	3	2	1	4	24

Activity/Impact	Site clearance and topsoil removal prior to the commencement of physical construction activities across the project area				
Criteria	**Details / Discussion**				
Description of Impact	The removal of vegetation and topsoil for site clearing will have a negative visual impact on the receiving environment. The project area will become noticeable to the nearby receptors as it will contrast the surrounding areas.				
Mitigation Required	The following mitigation measures are recommended: ■ Vegetation and topsoil should only be removed when and where necessary; and ■ Topsoil stockpiles should be vegetated.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*

Pre-Mitigation	3	5	3	6	66
Post-Mitigation	3	5	3	5	55

Activity/Impact	The construction of waste rock dumps				
Criteria	**Details / Discussion**				
Description of Impact	Stockpiling waste rock will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.				
Mitigation Required	The following mitigation measures are recommended: ■ Overburden should only be removed when and where necessary; ■ Reduce the height of overburden stockpiles where possible; ■ Limit the height and footprint area of overburden stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; and ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	3	6	66
Post-Mitigation	3	5	3	5	55

Activity/Impact	The construction of topsoil stockpiles				
Criteria	**Details / Discussion**				
Description of Impact	Stockpiling topsoil will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.				
Mitigation Required	The following mitigation measures are recommended: ■ Topsoil should only be removed when and where necessary; ■ Limit the height of soil stockpiles to 3 metres to prevent the soil from becoming compacted and to reduce the visual impact; ■ Topsoil stockpiles should be vegetated so as to blend into the surrounding landscape; ■ Limit the height and footprint area of topsoil stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; and ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	3	6	66
Post-Mitigation	3	5	3	5	55

Activity/Impact	The establishment of the initial boxcut and access ramps to the open-pit mining areas				
Criteria	**Details / Discussion**				
Description of Impact	The establishment of the initial boxcut and access ramps to the open pit mining areas will have a negative visual impact on the receiving environment. Drilling and blasting to develop the initial boxcut for mining will result in noise and dust thereby attracting attention to the project area. The boxcut will dramatically contrast the surrounding agricultural area. This will leave a scar on the landscape. Dust from the blasting will also have a negative visual impact. This visual impact will occur for the life of the project.				
Mitigation Required	The following mitigation measures are recommended: ■ Only remove overburden when and where necessary; and ■ Apply dust suppression techniques to limit the dust created by blasting.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	4	7	84
Post-Mitigation	3	5	4	6	72

Activity/Impact	The establishment of underground access shaft				
Criteria	**Details / Discussion**				
Description of Impact	The establishment of the underground access shaft will have a negative visual impact on the receiving environment. This visual impact will be negligible as the underground access shaft will be located within the open pit area.				
Mitigation Required	The following mitigation measures are recommended: ■ Limit the height and footprint area of surface infrastructure where possible; ■ If surface infrastructure is to be painted, it should be painted natural hues so as to blend into the surrounding landscape where possible; and ■ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	1	5	1	4	24

Post-Mitigation	1	5	1	3	18

Activity/Impact	The construction of haul roads on site				
Criteria	**Details / Discussion**				
Description of Impact	The construction of haul roads will have a negative visual impact on the receiving environment.				
Mitigation Required	Do not create numerous haul roads alongside each other.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	2	3	2	4	28
Post-Mitigation	2	3	1	4	24

Activity/Impact	The construction of the access or service road				
Criteria	**Details / Discussion**				
Description of Impact	The construction of the access or service road will have a negative visual impact on the receiving environment.				
Mitigation Required	Do not create numerous roads alongside each other.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	1	3	1	4	20
Post-Mitigation	1	3	1	3	15

Activity/Impact	The construction of the hard park area (this is made up of the workshop, office block and parking lot)				
Criteria	**Details / Discussion**				
Description of Impact	The construction of hard park area will have a negative visual impact on the receiving environment. This hard park area includes the workshop, office block and parking lot. These visual impacts will occur for the life of the project. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place. The visual impacts from the construction area lighting will occur during the construction phase.				
Mitigation Required	The following mitigation measures are recommended: ■ Limit the height and footprint area of surface infrastructure where possible; ■ If the surface infrastructure is to be painted, it should be painted natural hues so as to blend into the surrounding landscape where possible; ■ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and ■ Avoid construction activities at night if possible, thereby avoiding the use of construction area lighting. If construction activities take place at night, down lighting should be implemented to minimise light pollution.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	2	3	2	6	42
Post-Mitigation	2	3	2	5	35

8.5.6.2 Operational Phase

Activity/Impact	Drilling and blasting of the overburden rock for easy removal by excavators and dump trucks
Criteria	**Details / Discussion**
Description of Impact	The removal of overburden by drilling and blasting will have a continual negative visual impact on the receiving environment. Overburden stockpiling will have a negative visual impact on the receiving environment. Dust from the blasting and from stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.

Mitigation Required	The following mitigation measures are recommended: ■ Only remove overburden when and where necessary; ■ Plant fast-growing endemic vegetation in areas where it can conceal stockpiles; ■ Limit the height and footprint area of overburden stockpiles where possible; and ■ Apply dust suppression techniques to limit the dust created by blasting and from the stockpiles.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	4	7	84
Post-Mitigation	3	5	4	6	72

Activity/Impact	Dumping of waste rock and maintenance of waste rock dump				
Criteria	**Details / Discussion**				
Description of Impact	Operation and maintenance of the waste rock dump will have a negative visual impact on the receiving environment. Dust from the dump will also have a negative visual impact on the receiving environment. These visual impacts will occur for the life of the project.				
Mitigation Required	The following mitigation measures are recommended: ■ Overburden should only be removed when and where necessary; ■ Limit the height and footprint area of stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; and ■ Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	3	6	66
Post-Mitigation	3	5	3	5	55

Activity/Impact	Removal and loading of ore onto trucks (O/C) or conveyor (U/G) to the plant				
Criteria	**Details / Discussion**				
Description of Impact	The removal of ore will have a continual negative visual impact on the receiving environment. Infrastructure and mine area lighting will be visible at night resulting in a negative visual impact on the receiving environment. This visual impact will occur for the life of the project.				
Mitigation Required	The following mitigation measures are recommended: ■ Limit the quantity and time of ROM stored on site; and ■ Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	4	7	84
Post-Mitigation	3	5	4	6	72

Activity/Impact	Vehicle movement on haul roads
Criteria	**Details / Discussion**
Description of Impact	Vehicular activity on the haul roads and access or service road will have a negative visual impact on the receiving environment. Dust from vehicular activity will also have a negative visual impact. These visual impacts will occur for the life of the project.
Mitigation Required	The following mitigation measures are recommended: ■ Do not create numerous haul roads alongside each other; ■ Roads should be wetted frequently by means of a water bowser to suppress dust; and ■ Vehicles must be roadworthy and obey the recommended speed limits at all times.

Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	2	5	2	4	36
Post-Mitigation	2	5	1	4	32

Activity/Impact	Continuing operation and maintenance of the stockpiles, including topsoil and ROM stockpiles
Criteria	**Details / Discussion**
Description of Impact	Operation and maintenance of the topsoil and ROM stockpiles will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact on the receiving environment. These visual impacts will occur for the life of the project.
Mitigation Required	The following mitigation measures are recommended: ■ Topsoil should only be removed when and where necessary; ■ Limit the height of soil stockpiles to 3 metres to prevent the soil from becoming compacted and to reduce the visual impact; ■ Topsoil stockpiles should be vegetated so as to blend into the surrounding landscape; ■ Limit the height and footprint area of stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; ■ Limit the quantity and time of ROM stored on site; and ■ Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.

Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	3	6	66
Post-Mitigation	3	5	3	5	55

Activity/Impact	Concurrent replacement of overburden and topsoil and the re-vegetation of mined out strips. The mined strip will be backfilled with overburden and compacted. Subsequently, the topsoil will be placed on top of the overburden and the area will be vegetated				
Criteria	**Details / Discussion**				
Description of Impact	Concurrent rehabilitation by replacement of overburden and topsoil as well as re-vegetation as mining progresses will have a neutral visual impact on the receiving environment. The aim of rehabilitation is to return the project area to a state similar to the pre-mining state. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment. Backfilling of the open pit with overburden will use rock removed from the void of the current mining strip to partly fill the mined out void in the previously mined strip. Once backfilling commences, overburden should no longer be added to the overburden stockpiles. This will have a neutral visual impact on the receiving environment. Spreading of topsoil and re-vegetation of the backfilled areas will have neutral visual impacts on the receiving environment.				
Mitigation Required	The following mitigation measures are recommended: ■ Backfill as much of the open pit area as possible; ■ Spread topsoil over the backfilled area; and ■ Re-vegetate the backfilled area.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	4	7	84
Post-Mitigation	*This is a positive impact with a neutral net benefit.*				

8.5.6.3 Decommissioning Phase

Activity/Impact	Removal of surface infrastructure (plant machinery, shafts, conveyors)
Criteria	**Details / Discussion**
Description of Impact	Demolition and removal of infrastructure will have a neutral visual impact on the receiving environment. This will help to reverse some of the changes that occurred when the infrastructure was constructed.
Mitigation Required	Ensure that all unnecessary infrastructure is demolished and removed from the site.

Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	2	3	2	6	42
Post-Mitigation	*This is a positive impact with a neutral net benefit.*				

Activity/Impact	Rehabilitation of roads and cleared areas (offices and workshop area)				
Criteria	**Details / Discussion**				
Description of Impact	Rehabilitation of the roads and cleared areas by replacement of topsoil will have a neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-mining state. Spreading of topsoil, and profiling and contouring to create a free-draining topography will have a neutral visual impact. Re-vegetation of the rehabilitated areas will have a neutral visual impact. These visual impacts will be permanent. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment.				
Mitigation Required	The following mitigation measures are recommended: ■ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ■ Spread topsoil over the rehabilitated area; ■ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; and ■ Re-vegetate the rehabilitated areas.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	2	3	2	4	28
Post-Mitigation	*This is a positive impact with a neutral net benefit.*				

Activity/Impact	Final placement of overburden and topsoil and the establishment of vegetation on the final opencast void. Overburden will be backfilled into the final void and compacted. Subsequently, topsoil will be placed and the area vegetated
Criteria	**Details / Discussion**

<table>
<tr><td>Description of Impact</td><td colspan="5">Rehabilitation of the final open void (where possible) by replacement of overburden and topsoil will have a neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-mining state. Once ore has been removed from the open pit, there will be insufficient overburden to fill the void completely. Due to this material imbalance, a permanent void will remain.

Spreading of topsoil, and profiling and contouring to create a free-draining topography will have a neutral visual impact. Re-vegetation of the rehabilitated areas will have a neutral visual impact.

These visual impacts will be permanent. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment.</td></tr>
<tr><td>Mitigation Required</td><td colspan="5">The following mitigation measures are recommended:
■ Backfill as much of the final void as possible;
■ Ensure that the final void is as small as practically possible;
■ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
■ Spread topsoil over the rehabilitated area;
■ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; and
■ Re-vegetate the rehabilitated areas.</td></tr>
<tr><td>Parameters</td><td>Spatial Scale</td><td>Duration</td><td>Intensity</td><td>Probability</td><td>Significance Rating</td></tr>
<tr><td>Pre-Mitigation</td><td>3</td><td>5</td><td>4</td><td>7</td><td>84</td></tr>
<tr><td>Post-Mitigation</td><td colspan="4">This is a positive impact with a neutral net benefit.</td><td></td></tr>
</table>

8.5.6.4 Closure/Post Closure Phase

Activity/Impact	Post-closure monitoring and rehabilitation will determine the level of success of the rehabilitation, as well as to identify any additional measures that have to be undertaken to ensure that the mining area is restored to an adequate state. Monitoring will include surface water, groundwater, soil fertility and erosion, natural vegetation and alien invasive species and dust generation from the discard dumps				
Criteria	**Details / Discussion**				
Description of Impact	Post-closure monitoring and rehabilitation is essential to limit the impact of the proposed Lanxess Chrome Mine Expansion Project on the receiving environment. This is a neutral impact that will help to reverse some of the negative impacts.				
Mitigation Required	The following mitigation measures are recommended: ■ Ensure that all disturbed areas are rehabilitated to a state as close as possible to the pre-mining state; and ■ Carefully monitor the rehabilitated areas to ensure that rehabilitation is successful.				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	3	5	4	7	84
Post-Mitigation	*This is a positive impact with a neutral net benefit.*				

8.5.7 Potential Impacts on Ambient Noise Levels (Please refer to detailed report in Appendix G)

8.5.7.1 Construction Phase

Activity/Impact	Site clearance and construction activities
Criteria	**Details / Discussion**
Description of impact	Mining machinery and vehicles is expected to increase ambient noise levels on site, but according to the dispersion models the noise levels are expected to be restricted to site. The negligible impacts are due to the noise not impacting on the surrounding sensitive receptors.
Mitigation required	The following mitigation measures are recommended: ■ Restricting construction activities to daylight hours where viable; ■ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and

Activity/Impact	Site clearance and construction activities				
Criteria	**Details / Discussion**				
	■ Switching off equipment when not in use.				
Parameters	*Spatial*	*Duration*	*Severity*	*Probability*	*Significant rating*
Pre-Mitigation	2	2	2	3	18
Post-Mitigation	1	2	1	2	8

8.5.7.2 Operational Phase

Activity/Impact	Drilling, blasting and operational activities				
Criteria	**Details / Discussion**				
Description of impact	Mining machinery and vehicles is expected to increase ambient noise levels on site, but according to the dispersion models the noise levels are expected to be restricted to site. The negligible impacts are due to the noise not impacting on the surrounding sensitive receptors.				
Mitigation required	The following mitigation measures are recommended: ■ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ■ Switching off equipment when not in use.				
Parameters	*Spatial*	*Duration*	*Severity*	*Probability*	*Significant rating*
Pre-Mitigation	2	5	2	3	27
Post-Mitigation	1	5	1	2	14

8.5.7.3 Decommissioning Phase

Activity/Impact	Demolition and removal of surface infrastructures and rehabilitation works
Criteria	**Details / Discussion**
Description of impact	Mining machinery and vehicles is expected to increase ambient noise levels on site, but due to the limited activities the noise levels are expected to be restricted to site. The negligible impacts are due to the noise not impacting on the surrounding sensitive receptors.

Activity/Impact	Demolition and removal of surface infrastructures and rehabilitation works				
Criteria	**Details / Discussion**				
Mitigation required	The following mitigation measures are recommended: ■ Restricting construction activities to daylight hours where viable; ■ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ■ Switching off equipment when not in use.				
Parameters	*Spatial*	*Duration*	*Severity*	*Probability*	*Significant rating*
Pre-Mitigation	2	2	2	3	18
Post-Mitigation	1	2	1	2	8

8.5.7.4 Closure/Post Closure Phase

Activity/Impact	All noise causing activities have ceased during this phase				
Criteria	**Details / Discussion**				
Description of Impact	The noise impact during this phase will be neutral due to the expected ambient noise level returning to pre-mining baseline.				
Mitigation Required	None required				
Parameters	*Spatial Scale*	*Duration*	*Intensity*	*Probability*	*Significance Rating*
Pre-Mitigation	1	7	1	7	63
Post-Mitigation	*This is a positive impact with a neutral net benefit.*				

8.6 Item 3(g)(vi): Methodology Used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

This section describes how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision.

The descriptions and scales of the terms used to define the impact significance and the Impact significance matrix are provided in Table 8-18 and Table 8-19 respectively. Impact significance classification is depicted in Table 8-20. The method provides an indication in relative terms of the significance of potential impact on the atmospheric environment.

The system is based on ordinal data where a number is used to represent a category. Ordinal data allows for an increase or decrease in the scoring to provide a relative indication which cannot be interpreted on a linear scale.

The methodology determines the environmental significance using the following equation:

Significance of environmental impact = Consequence X Probability

The consequence of an impact can be derived from the following factors:

- Spatial extent;
- Duration of impact; and
- Severity / magnitude.

Duration is defined by how long the impact may be prevalent and spatial scale is the physical area which could be affected by an impact. The severity of an impact relates to how severe the impact will be. The overall probability of the impact can be determined, and is related to the likelihood of such an impact occurring.

Table 8-19, and then the overall consequence is determined by adding the individual scores.

Environmental impacts are obtained by multiplying the consequence of the impact with the probability of occurrence, as follows:

Significance = Consequence x Probability

Where

Consequence = Severity (1-7) + Extent (1-7) + Duration (1-7)

And

Probability = Likelihood of an impact occurring (1-7)

The maximum score that can be obtained is 147 significance points.

The impact rating process is designed to provide a numerical rating (scores from 1 to 7) of the various environmental impacts identified for various project activities. The matrix calculates the rating out of 147. The significance of an impact is then determined and categorised into one of four categories (Table 8-20). The assessment is done for all activities that were predicted to have an air quality impact.

Environmental impacts are rated as Major, Moderate, Minor and Negligible based on the significance scoring

More than 108 points indicate Major environmental significance;

- Between 73 and 108 points indicate Moderate environmental significance;
- Between 33 and 73 points indicate Minor environmental significance; and
- Less than 33 points indicate negligible environmental significance.

Table 8-18: Descriptions and scales of the terms used to define the impact significance

Rating	Severity	Spatial scale	Duration	Probability
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	International The effect will occur across international borders.	Permanent: No Mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain/ Definite. The impact will occur regardless of the implementation of any preventative or corrective actions.

Rating	Severity	Spatial scale	Duration	Probability
6	Significant impact on highly valued species, habitat or ecosystem.	National Will affect the entire country.	Permanent: Mitigation Mitigation measures of natural process will reduce the impact.	Almost certain/Highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.	Province/ Region Will affect the entire province or region.	Project Life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.	Municipal Area Will affect the whole municipal area.	Long term 6-15 years	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	Local Local extending only as far as the development site area.	Medium term 1-5 years	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.

Rating	Severity	Spatial scale	Duration	Probability
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants.	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures
1	Limited damage to minimal area of low significance, (e.g. ad hoc spills within plant area). Will have no impact on the environment.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month	Highly unlikely/None Expected never to happen.

Table 8-19: Impact significance matrix as a product of consequence and probability

Significance									
		Consequence (severity + scale + duration)							
		1	3	5	7	9	11	15	18	21
Probability / Likelihood	1	1	3	5	7	9	11	15	18	21
	2	2	6	10	14	18	22	30	36	42
	3	3	9	15	21	27	33	45	54	63
	4	4	12	20	28	36	44	60	72	84
	5	5	15	25	35	45	55	75	90	105
	6	6	18	30	42	54	66	90	108	126
	7	7	21	35	49	63	77	105	126	147

Table 8-20: Impact significance classification based on the significance scoring

Significance		
High (Major)	**108- 147**	
Medium-High (Moderate)	**73 - 107**	
Medium-Low (Minor)	**36 - 72**	
Low (Negligible)	**0 - 35**	

8.7 Item 3(g)(vii): The Positive and Negative Impacts that the Proposed Activity (in terms of the initial site layout) and Alternatives will have on the Environment and the Community that may be Affected

As motivated in Sections 8 and 14 of Part A, no alternatives other than the preferred alternative have been assessed. Therefore this section will outline the positive and negative impacts of the preferred option.

8.7.1 Positive Impacts

Positive impacts that the proposed activity will have on the receiving environment include:

- Continued employment;
- Continued skills development;

- Continued contribution to GDP;
- Eradication of alien species present in the area where the open pit area is envisaged;
- During rehabilitation, soil monitoring, associated treatment of soil, and re-vegetation of disturbed areas will have a positive impact on soil;
- Increased groundwater quantity will be positive due to groundwater ingress into the workings until the final decant elevations and hydraulic gradients are reached;
- The replacement of overburden and topsoil throughout the life of mine as well as the final replacement during the decommissioning phase may result in the restoration of the natural vegetation; and
- Backfilling of open cast voids and re-vegetation of the rehabilitated area will have a positive impact on the quantity of water reporting to the rivers as natural drainage pattern will be restored.

8.7.2 Negative Impacts

Negative impacts that the proposed activity will have on the receiving environment include:

- Dust generated by various operational aspects such as crushing and screening, dumping of waste rock and the transport of material encompasses Total Suspended Particulates (TSP), PM_{10} and $PM_{2.5}$, which may cause respiratory issues;
- The existing vegetation within the proposed area of development will be impacted on as the existing vegetation (mostly agricultural fields) will be removed to facilitate the construction of mine and related infrastructure;
- Vehicular activity could impact on faunal species in terms of road deaths;
- The establishment of the underground access shaft could have an impact on the groundwater system due to blasting activities;
- Groundwater inflows into the shafts may lead to localised dewatering;
- Increased AMD potential;
- Significant influxes of groundwater can occur during underground mining. This influx inevitably dewaters and lowers groundwater levels in the surrounding mining area;
- Increase in turbidity of surface water runoff during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles which is high in suspended solids;
- Blasting material during operational phases releases ammonium nitrates from the explosive residues. This chemical contaminates the water in the pit and can potentially contaminate the streams if water is discharge into the natural environment;
- Potential loss of topsoil during the removal and stockpiling of soil;

- Potential loss of land capability due to the removal of soil layers; and
- Increased ambient noise levels at surrounding noise sensitive receptors.

8.8 Item 3(g)(viii): The Possible Mitigation Measures that could be Applied and the Level of Risk

8.8.1 Mitigation Measures Relating to Potential Impacts on Air Quality

In terms of material handing operations, the elimination of dust generation at transfer points is not feasible; however, this can be controlled to fall within compliance. An enclosure at the transfer points is necessary to control emissions. Fall heights of the transfer points should be reduced though the use of spiral chutes. Load profiling creates a consistent surface of ore in each truck, which would be implemented at the mine. The magnitude of ore dust emissions from transport of ore in trucks will depend on a number of factors, such as the level of exposure of the open surface to air moving at high speeds and the inherent dustiness of the material. Measures that can be applied include: potential modifications to trucks to reduce wind contact with ore during transport, employ water or air blow-down to reduce parasitic loads on trucks exiting load-out bay. Dust can be mitigated using water and having an enclosure on the crushers. To manage the fugitive dust, the feed side of the crusher must be enclosed.

In terms of the use of haul roads, as ore will be transported for a longer distance from the western shaft to the plant, dust will be generated. The fugitive dust from haul roads increases the particulate loading of the atmosphere and at the same time reduces visibility. Effective dust management measures reduce fugitive dust from haul roads. The effectiveness of dust suppressant is proven on haul roads. Dust suppressants work by forming a layer over the top of the roads i.e. dust-a-aside. Road construction should have the following properties: resistance to wear, soundness, maximum size, particle shape and gradation.

Reducing speed on haul roads is also an effective way to manage fugitive dust. However, reducing speed may lower the production of mines. Reducing speed reduces the generation of particles less than 10 micro meters by about 58% when speed controls are reduced from 25 mph (40 km/h) to 15 mph (24 km/h). Reducing the volume of traffic on the haul roads reduces the impacts of dust entrainment.

Lastly, when loads are covered by tarps, the loaded material is prevented from being airborne. Entrainment may occur when air flow comes into contact with materials exceed 21 km/h for small material (0.1 mm) large materials require high velocities. Wetting of the loaded materials can be done to keep the material moist and further reduce the dust generated.

8.8.2 Mitigation Measures Relating to Potential Impacts on Fauna and Flora

8.8.2.1 Avoid Sensitive Habitats

Avoidance of the rocky bushveld, areas and koppies are strongly recommended. If possible, low sensitivity areas must be favoured for infrastructure placement such as the fallow fields.

8.8.2.2 Rescue and Relocation of Flora

It is recommended that rehabilitation efforts for small areas cleared during construction and not used for operation commence as soon as the project is initiated both prior and during construction activities.

Collection of indigenous grass, herb and shrub seeds is recommended prior to construction activities.

It is recommended that the rocky bushveld, bushveld areas and koppies are set aside as biodiversity corridor and conservation areas (throughout the life of the operation and beyond)

Cattle should be excluded from these areas (or managed correctly within them) and the invasive and problem plant species controlled. Restoration should also occur to restore natural habitat for naturally occurring species of special concern.

8.8.2.3 Rescue and Relocation of Fauna

Mammal Species of Special Concern (SSC) is expected to be capable of moving away from habitat impacted by operational activities to habitat which is not impacted by current activities. Fences within the Project Area should be taken down in order to allow for easier movement by species.

Bird SSC is expected to be capable of flying away from habitat impacted by current operational activity to habitat which is not impacted by open pit activities. It is recommended that before and during the construction phase an ecological audit is undertaken to ensure that birds of special concern breeding sites are not within the construction areas. SSC should be avoided where possible. If avoidance is not probable then relocation is obligatory.

A competent and qualified person should undertake an ecological audit prior to construction to ensure that all burrowing animals have moved away from the disturbance and fauna that might be harmed and are unable to move away are relocated.

8.8.3 Mitigation Measures Relating to Potential Impacts on Surface Water Bodies

All the water being pumped from the pit should be diverted into the existing Pollution Control Dams (PCD's) for re-use on the mine so as to prevent unnecessary discharge into the environment.

Based on Regulation 704 requirements (as per the NWA) regarding storm water management for mining activities, it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the mine must be diverted away and discharged to the nearby watercourse or environment. The clean water diversion must be sized to accommodate the 1:50 year storm event.

Should the contained water be more than the water use requirement, the BPGs advices that the water be recycled or as the last resort be treated to acceptable levels and discharged either to the natural environment or be supplied to other industries as a lower grade of water.

8.8.4 Mitigation Measures Relating to Potential Impacts on the Geohydrological Environment

8.8.4.1 Mitigation and Management during Construction Phase

- Undertake groundwater intrusive investigation around the shaft to optimise the position of the shaft and associated infrastructure to avoid major water bearing features;
- Handle and store blasting material according to manufacturing requirements;
- Establish the depth to groundwater table prior to construction;
- Grout or pump out any significant inflow of groundwater during shaft construction to ensure a dry and safe working environment;
- Depending on the quality of the groundwater, discharge, store or recycle as appropriate; and
- Monitor quality of mine water.

8.8.4.2 Mitigation of and Management of Mine Dewatering during Operation Phase

- Dewater very closely to the active mining face;
- Manage groundwater abstraction rates and volumes in accordance with borehole sustainable yields;
- Monitor groundwater abstractions to ensure that the aquifer from which water is abstracted is not over-exploited;
- Pump excess underground water to appropriate surface storage facility according to manage and minimise the water quality impacts. When required by the process plant, the abstracted water can be discharged into the return water dam;
- Reuse water as far as possible. An off-take can be installed from the reservoir to the vehicle maintenance bay for use in dust suppression activities and general usage at the bay. However, for dust suppression it is good practice to first use marginal mine water or grey water before using pristine groundwater; and

- Monitor water influx, water stored, water removed; and water levels in the underground mine and groundwater levels in the perimeter of the underground mine.

8.8.4.3 Mitigation and Management of Mine Water Contamination during Operation Phase

- The mine water management measures recommended during construction phase should continue during the operational phase;
- It is recommended that abstraction from boreholes that are close to the mine workings should be avoided so that contaminants will not migrate away from the mine, towards the abstraction boreholes;
- Monthly or quarterly monitoring of groundwater qualities and water levels are recommended (particularly down gradient of the mine site) with continuous refining and updating of the monitoring network based on the results obtained;
- Annual audits of monitoring and management systems should be conducted by independent environmental consultants; and
- With the application of the above-stated mitigation plans, the impact of the contaminant migration during construction phase can be lowered to negligible.

8.8.4.4 Mitigation and Management of Mine Decant during Closure and Post-closure Phase

- Monitor water level rise and apply stage curves to assess the rate of flooding;
- Seal mine shafts to prevent surface water from flowing into the defunct underground voids;
- Seal all boreholes that connects the mine void to surface;
- Monitor groundwater levels in boreholes in the surrounding aquifers to assess groundwater table responses; and
- Groundwater monitoring should continue up to 5 years after closure.

8.8.4.5 Mitigation and Management of Mine Water Contamination during Closure and Post-closure Phase

- No abstraction boreholes should be drilled in a 3 km radius from the underground workings in the post closure environment;
- Perform effective rehabilitation and closure of redundant facilities through material placing and shaping, capping with appropriate capping liners and re-vegetation to prevent post closure infiltration through sources; and

Consider groundwater plume remediation only if post closure monitoring indicates a persistent pollution plume at unacceptable concentrations.

8.8.5 Mitigation Measures Relating to Potential Impacts on Soils, Land Capability and Land Use

The following measures are to be put in place to mitigate impacts on soils, land capability and land use:

- Stockpiles are to be kept to a maximum height of 4 m (the practical tipping height of dump trucks);
- Topsoil is to be stripped when the soil is dry, so as to reduce compaction;
- The topsoil 0.3 m of the soil profile should be stripped first and stockpiled separately;
- The subsoil approximately 0.7 – 0.9 m thick will then be stripped and stockpiled separately;
- Soils to be stripped according to the rehabilitation soil management plan and stockpiled accordingly;
- Foundation excavated soil should also be stockpiled;
- Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for macro nutrients and pH;
- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate;
- Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles;
- The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil;
- Soils will be stripped using the delineated soil types as a guide. Yellow and red soils may be stripped together. Wetland soils (if allowed) should be stripped and stockpiled separately but also in the order topsoil (0.3 m) then subsoil separately;
- The designed post mining landforms should be modelled to establish the post mining landscape stability by using a combination of GIS and erosion modelling techniques by a suitably qualified expert using site specific soil quality data;
- The soil layers should be put back in the reverse order of stripping namely subsoil first then topsoil;
- The yellow and red soils should be replaced in upland landscape positions;
- The soil quality should be investigated prior to establishing vegetation on the rehabilitated soil through representative sampling and laboratory analysis; and
- Clear targets incorporating medium to long term post mining land capability influencing land use, should be part of a potentially successful closure plan.

8.8.6 Mitigation Measures Relating to Potential Impacts on Ambient Noise Levels

The following mitigation measures can be put in place to abate increased noise levels:

- Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers and switching off equipment when not in use;
- As for the blasting operations, it is generally intermittent and should be limited to daylight hours when ambient noise levels are highest;
- The following with regards to blasting operations is recommended:
  - The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended;
  - Reduction of the powder factor, that is, use of less explosive per cubic yard of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed; and
  - Maintaining good public relations with the surrounding communities i.e. warning the local communities in advance before blasts.

8.9 Item 3(g)(ix): Motivation Where No Alternatives Sites Were Considered

Lanxess already has an approved EIA/EMP in line with the MPRDA for its current operations on various portions of the farms Rietfontein 338 JQ, Kroondal 304 JQ and Klipfontein 300 JQ. No property alternatives have therefore been considered as the envisaged mining operations will occur on properties already utilised for the mining operations or on properties that the Mine currently own. Furthermore, the chrome reserve is limited to the preferred site.

8.10 Item 3(g)(x): Statement Motivating the Alternative Development Location within the Overall Site

No property alternatives have been considered as the envisaged mining operations will occur on properties already utilised for the mining operations (for which Lanxess holds the mining rights) or on properties that the Mine currently own. Furthermore, the chrome reserve is limited to the preferred site.

9 Item 3(h): Full Description of the Process Undertaken to Identify, Assess and Rank the Impacts and Risks the Activity will Impose on the Preferred Site (In respect of the final site layout plan) through the Life of the Activity

Please refer to Section 8.6 above for a description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site.

Please refer to Section 10 below for a description of all environmental issues and risks that were identified during the environmental impact assessment process.

10 Item 3(i): Assessment of each identified potentially significant impact and risk

(This section of the report must consider all the known typical impacts of each of the activities (including those that could or should have been identified by knowledgeable persons) and not only those that were raised by registered interested and affected parties)

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
Crushing and screening	Air quality	During this stage, the ore from the underground operations and the open pit will be crushed to reduce the size. The dust generated encompasses TSP, PM_{10} and $PM_{2.5}$ (which may impact the human respiratory system due to the depth of penetration and the resultant interaction with human tissues).	Operational	72	To mitigate the impacts, the crusher should be enclosed to control the dust that is generated in the process. The application of water sprayers also helps to suppress generated dust thus reducing the impact.	50
Dumping of waste rock	Air quality	During this stage, waste rock brought to the surface and those from the open pit process is loaded onto 30 tonne tipper trucks and offloaded at the waste rock dumps. The loading and offloading process results in dust generated comprises TSP, PM_{10} and $PM_{2.5}$ (this fraction is causing health problem in the human respiratory system due to the depth of penetration and the resultant interaction with human tissues).	Operational	66	To mitigate the impacts of the loading and dumping process, the drop height when offloading must be lowered.	50
Stockpiling material	Air quality	Materials i.e. ROM, lumpy ore, crusher fines, HMS fines and stockpiles CO1, CO4 and CO6 are stored at their respective stockpiles. The various stockpiles thus represent sources of dust, with the subsequent erosion of dust that comprises TSP, PM_{10} and $PM_{2.5}$.	Operational	55	To mitigate the impacts of the stockpiling, water sprays on the stockpiles need to be utilised, use of wind breaks can be implemented near the respective stockpiles as these reduce anticipated dust impacts by 30%.	40
Transporting material	Air quality	This focuses on the use haul roads and the conveyance of chrome using conveyor belts. During this stage, materials are transported to the various stockpile using 3 tonne tipper trucks, which leads to the generation of fugitive dust comprising TSP, PM_{10} and $PM_{2.5}$.	Operational	78	To mitigate the impacts, vehicle speeds must be reduced that will, in turn, reduce emissions into the atmosphere. Water sprays on the road should be used frequently, keeping the road moist. Dust suppressants such as Dust-a-side can be applied on the haul roads. The construction of speed humps and enforcement of speed limits will also reduce the generation of dust.	60
Decommissioning	Air quality	This activity entails the removal of buildings and foundations and rehabilitation of the voids and spreading of sub soil and topsoil. The reshaping and restructuring of the landscape though spreading of subsoil and topsoil will generate dust as soil is being transferred from one location to another. There is movement and transfer of soil to rehabilitate the void.	Decommissioning	54	Spreading of soil must be performed on less windy days. The bare soil will be prone to erosion there is need to introduce surface vegetation cover to check erosion. Leaving the surface of the soil in a coarse condition reduces wind erosion and ultimately reduces the dust levels. Additional mitigation measures include keeping the soil moist using sprays or water tanks, using wind breaks. The best time to re-vegetate the area must be linked to the distribution and reliability of the rainfall.	40
Site clearance and topsoil removal prior to the	Fauna and Flora	The almost complete degradation of natural	Construction	40	■ Limit degradation and destruction of natural	36

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
commencement of physical construction activities across the open pit area		vegetation and habitat for animal life has already taken place within the general environment due to current land use practices specifically agricultural. No natural vegetation remains within the project area, therefore none will be impacted on, except for the eastern edge of the open pit that will impact on medium high sensitivity Bushveld. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.			environment to designated project areas by keeping the footprint of the disturbed area to the minimum and within designated areas only. Re-vegetate open areas to limit erosion. ■ Avoid sensitive landscapes such as the Koppies that were encountered on site. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.	
The construction of waste rock dumps	Fauna and Flora	No natural vegetation remains within the waste rock dump area, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.	Construction	36	■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the rock dump within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.	32
The construction of topsoil stockpiles	Fauna and Flora	No natural vegetation remains within the topsoil stockpiles area, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.	Construction	54	■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the topsoil stockpiles within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed	42

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
					bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.	
The establishment of the initial boxcut and access ramps to the open pit mining areas	Fauna and Flora	No natural vegetation remains within the initial boxcut area, therefore none will be impacted on. The agricultural fields have a low sensitivity rating. The impact will be site specific in extent. The severity of the impact was determined to be low.	Construction	36	■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the initial boxcut within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used. ■	32
The construction of haul roads on site	Fauna and Flora	No natural vegetation remains within the haul roads locations, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.	Construction	36	■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the haul roads within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.	32
The construction of the access or service road	Fauna and Flora	No natural vegetation remains within the access or service road locations, therefore none will be impacted on. The agricultural fields have a	Construction	54	■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the access and service roads within	42

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.			the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.	
The construction of the hard park area	Fauna and Flora	No natural vegetation remains within the hard park area location, therefore none will be impacted on. The agricultural field have a sensitivity rating of low. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be low.	Construction	54	■ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the hard park area within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ■ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ■ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used.	42
Vehicular activity on haul roads, use of hall roads	Fauna and Flora	Vehicular activity could impact on fauna species in terms of road deaths; signs of road deaths were evident during field work. Furthermore, the vehicular activity will result in the creation of soil based dust which will increase the deposits these materials on plant leaves, blocking stomata and inhibiting evapotranspiration. Natural dust will be created from use of the haul road and ash dust will be created during transport by haul trucks. This will impact on the vegetation health and availability as food items as well as inhibit the ability of the plants units to provide ecological services.	Operational	50	■ Prevent excess dust creation that could inhibit plant growth by wetting of the haul roads to suppress dust creation as well as cover haul trucks to prevent dust emissions during transport. ■ To avoid animal deaths specific speed limits must be adhered to by all mining vehicles.	40
Concurrent replacement of overburden and topsoil and the re-vegetation of mined out strips	Fauna and Flora	This may be considered to be a positive impact if implemented properly over time. The replacement of overburden and topsoil throughout the	Operational	10	■ Reduce areas available for alien infestation by restoring disturbed areas to natural habitat. ■ Implementation of an alien invasive management	39

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		concurrent rehabilitation during the operational phase may result in the reduction of available space for alien invasive species, soil erosion and soil compaction, associated with top soil storage areas. This activity will create favourable habitat for indigenous plant species, and promote rehabilitation efforts, if completed correctly.			program is imperative to reduce the risk of these plant species infesting the mine area.	
Removal of infrastructure	Fauna and Flora	Of concern here is the creation of favourable habitat for fast growing invasive species and ground compaction. Also of concern are the possible spillages from infrastructure holding hazardous material. The demolition of infrastructure may require vehicles making use of non-designated areas, special care must be taken not to destroy rehabilitated areas.	Decommissioning	32	■ Avoid spillage of hazardous materials, thereby protecting vegetation and soil. The correct and careful handling of the infrastructure housing pollutants and toxicants to prevent spillages and leaks. ■ Avoid destruction of vegetation, the creation of favourable habitat for fast growing invasive plants and ground compaction, by forcing vehicles to make use of existing roads and designated areas. Avoid rehabilitated and natural habitat areas as far as possible. ■ The implemented alien invasive control program must be adhered to carefully.	28
Final replacement of overburden and topsoil and the establishment of vegetation on the final open cast void. Overburden will be backfilled into the final void and compacted. Subsequently, topsoil will placed and the area vegetated	Fauna and Flora	This may be considered to be a positive impact if implemented properly, and managed over time. The replacement of overburden and topsoil throughout the life of mine as well as the final replacement during the decommissioning phase may result in the restoration of the natural vegetation.	Decommissioning	8	■ The footprint of the area disturbed by the mining operation will have topsoil and overburden replaced to restore the vegetation cover, through proper rehabilitation. ■ Limit the erosion potential of exposed areas by re-vegetation. ■ Re-vegetated areas will form seepage areas which will help aid infiltration.	65
Post-closure monitoring and rehabilitation	Fauna and Flora	This activity will commence only after closure has taken place, furthermore this activity will be on-going after operations in the area has stopped.	Closure/Post closure	8	■ Direct rehabilitation efforts by ensuring correct measures are employed for a variety of rehabilitation projects. ■ Avoid erosion, alien invasive species establishment, by monitoring rehab outcome to ensure open areas	65

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
					are eliminated.	
Impacts on surface water during construction phase	Surface Water	■ Increase in turbidity of surface water runoff during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles; and ■ Impacts on surface water quality as a result of accidental spillages of hazardous substances (hydrocarbons) from construction vehicles used during site clearing and grubbing.	Construction	54	■ Clearing of vegetation should be limited to the project site, and the use of existing access roads should be prioritized so as to limit the construction of new access roads in these areas; ■ The construction phase should be limited to the dry months of the year (May-October) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing and grubbing; ■ The removed topsoil should be covered or vegetated as soon as possible to prevent sediment erosion; Haul roads need to be well compacted to avoid erosion of the soil into the stream.	28
Impacts on surface water during operational phase	Surface Water	■ Unconfined stormwater runoff from dirty water areas in the mine have the potential to contaminate the natural water resources; ■ Diversion of clean water runoff upstream of the mine dirty water area Water upstream of the mine area is considered clean and will have to be separated from the dirty water area. ■ Blasting during the operational phase will release ammonium nitrates from the explosive residues. This chemical will contaminate the water in the pit and may potentially contaminate the streams if water is discharged into the natural environment. Nitrates and ammonia from blasting residues, can lead to eutrophication (nutrient enrichment) of water bodies. They may also be converted into toxic nitrites. Ammonia (NH3 as opposed to NH4+) is highly toxic to fish and many aquatic organisms at even low (µg/l) concentrations; ■ Impacts on surface water quality as a result of mobilized hazardous substances (hydrocarbons) from trucks and machinery during operation of mine; and ■ Inadequate storm water management and soil stabilisation measures in cleared areas could lead to erosion that may result in siltation of	Operational	60	■ Dust suppression measures should be implemented to prevent the spread of dust and erosion of loose materials; ■ The topsoil stockpiles should be vegetated as soon as possible to prevent dust, erosion and siltation of the water bodies; ■ The storage facilities for fuel, lubricant and explosives must comprise a hard standing area (paved or concrete surface) and be roofed and bunded. This will prevent mobilisation of leaked hazardous substances. Emergency spillage response plan should in place and accessible to the responsible monitoring team; ■ All the water being pumped from the pit should be stored in the existing pollution control dams (PCD's) for re-use on the mine so as to prevent unnecessary discharge into the environment; ■ Based on Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the mine must be diverted away and discharged to the nearby watercourse or environment; The clean water diversion must be sized to accommodate the 1:50 year storm event. ■ Should the contained water be more than the water	32

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		nearby watercourses.			use requirement, the BPGs advises that the water be recycled or as the last resort be treated to acceptable levels and discharged either to the natural environment or be supplied to other industries as a lower grade of water; and ■ As the open pit mining progresses, continuous rehabilitation should be implemented by backfilling the voids. This will ensure that the dirty water footprint area is decreased so that the volume of dirty water runoff required to be pumped out of the pit is significantly reduced.	
Impacts on surface water during decommissioning phase	Surface Water	■ Mobilization of leaked/spilled contaminants (hazardous and hydrocarbon containing material) from trucks and machinery during decommissioning phase could have an impact on the quality of water in the nearby streams; and ■ Backfilling of open cast voids and re-vegetation of the rehabilitated area will have a positive impact on the quantity of water reporting to the rivers as the natural drainage pattern i.e. runoff, will be restored.	Decommissioning	48	■ Use of accredited contractors for removal or demolition of infrastructures should be ensured; ■ The backfilled areas should be vegetated as soon as possible to prevent dust and siltation of the water bodies; ■ Inspection of the rehabilitated areas need to be undertaken to ensure that the surface profile encourages natural drainage, such that no ponding or standing water occurs after a rainfall event. ■ Where rehabilitation (grass seeding of topsoil cover) is not effective, sedimentation should be mitigated by installing silt traps at areas where the surface runoff enters the surface water resources; and ■ Water quality monitoring should continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented.	21
Impacts on surface water during closure/post closure phase	Surface Water	Decant of poor quality groundwater from the mining areas may have a negative impact on the surrounding surface water resources.	Closure/Post closure	54	■ Surface water quality monitoring should continue to ensure that there is no impact on the surrounding water resources emanating from the mine area.	28
The establishment of the underground access shaft	Geohydrology	During the construction phase, the establishment of the underground access shaft could have an impact on the groundwater system. The establishment of the shaft requires blasting which may negatively affect the groundwater quality if significant amounts of explosive are spilled or incompletely detonated.	Construction	24	■ Undertake groundwater intrusive investigation around the shaft to optimise the position of the shaft and associated infrastructure to avoid major water bearing features; ■ Handle and store blasting material according to manufacturing requirements; ■ Establish the depth to groundwater table prior to construction;	18

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
					■ Grout or pump out any significant inflow of groundwater during shaft construction to ensure a dry and safe working environment; ■ Depending on the quality of the groundwater, discharge, store or recycle as appropriate; and ■ Monitor quality of mine water.	
Mine dewatering	Geohydrology	Excavation of the proposed pit will change the topography. As a result groundwater from both catchments will flow towards the pit centre in response to hydraulic gradient.	Construction	24	■ Establish the depth to groundwater table prior to construction; ■ Minimise penetration into the groundwater table; ■ If groundwater table is to be penetrated to significant depth, dewater aquifer prior to excavations; ■ Depending on the quality of the groundwater, discharge, store or recycle as appropriate; and Obtain permission from regulating authority.	18
Mine water contamination	Geohydrology	Site clearing and removal of topsoil may lead to puddles of surface water in the cleared areas during the wet season and potentially lead to increased infiltration to the weathered aquifers. Oil or fuel spillages from site machinery may collect in the soils. During rainfall events, hydrocarbon compounds from oil and fuel in the soils may migrate to the aquifers with water infiltrating through these polluted areas.	Construction	24	■ Implement and train drivers to adhere to traffic rules; ■ Implement a vehicle maintenance schedule; ■ Install oil collection pans under vehicles; ■ Handle and store blasting material according to manufacturing requirements; ■ Minimise external contamination sources in the pit (diesel, oils, chemicals) as far as possible to ensure that groundwater flowing into the mine is contaminated; and ■ Monitor quality of mine water.	20
Mine dewatering – underground mining (new segments)	Geohydrology	In general, significant influxes of groundwater can occur during underground mining. This influx inevitably dewaters and lowers groundwater levels in the surrounding mining area. As more areas are mined, the zone of influence of the groundwater	Operational	48	■ Dewater very closely to the active mining face; ■ Manage groundwater abstraction rates and volumes in accordance with borehole sustainable yields; ■ Monitor groundwater abstractions to ensure that the	30

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		level drawdown migrates and expands as the groundwater system attempts to retain a state of equilibrium.			aquifer from which water is abstracted is not over-exploited; ■ Pump excess underground water to appropriate surface storage facility accordingly to manage and minimise the water quality impacts. When required by the process plant, the abstracted water can be discharged into the return water dam; ■ Reuse water as far as possible. An off-take can be installed from the reservoir to the vehicle maintenance bay for use in dust suppression activities and general usage at the bay. However, for dust suppression it is good practice to first use marginal mine water or grey water before using pristine groundwater; and ■ Monitor water influx, water stored, water removed; and water levels in the underground mine and groundwater levels in the perimeter of the underground mine.	
Mine water contamination	Geohydrology	The current impact on groundwater quality lies in the vicinity of the old underground workings. Mining at the new segments is therefore predicted to increase the TDS levels of groundwater pumped from underground.	Operational	60	■ The mine water management measures recommended during construction phase should continue during the operational phase; ■ It is recommended that abstraction from boreholes that are close to the mine workings should be avoided so that contaminants will not migrate away from the mine, towards the abstraction boreholes; ■ Monthly or quarterly monitoring of groundwater qualities and water levels are recommended (particularly down gradient of the mine site) with continuous refining and updating of the monitoring network based on the results obtained; ■ Annual audits of monitoring and management systems should be conducted by independent environmental consultants; and ■ With the application of the above-stated mitigation plans, the impact of the contaminant migration during construction phase can be lowered to negligible.	30
Mine dewatering	Geohydrology	The predicted inflow rates range between 1 027 and 1 684 m^3/d. When groundwater flows towards the pit (during mining) it inevitably dewaters and lowers the groundwater levels in the surrounding	Operational	30	■ Minimise groundwater influx into pit through optimisation of mining layout to minimise structural disturbance;	22

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		area. As the pits develop, the zone of influence of the groundwater level drawdown migrates and expands as the groundwater system attempts to retain a state of equilibrium.			■ Dewater aquifer prior to further excavations. Dewatering is more effective when operated very closely to the active mining face; ■ Manage groundwater abstraction rates and volumes in accordance with borehole sustainable yields; ■ Perform monitored groundwater abstractions to ensure that the aquifer from which water is abstracted is not over-exploited; ■ Pump excess pit water to appropriate surface storage facility according to water quality. When required by the process plant the abstracted water can be discharged into the return water dam; ■ Reuse water as far as possible. An off-take can be installed from the reservoir to the vehicle maintenance bay for use in dust suppression activities and general usage at the bay. However, for dust suppression it is good practice to first use "marginal" mine water before using pristine groundwater; and ■ Monitor water influx, water stored, water removed; water level in the pit and groundwater levels in the perimeter of the pit.	
Mine water contamination	Geohydrology	Any seepage emanating from the adjacent waste rock dump will eventually join the underlying saturated zone and migrate towards the pit due to hydraulic gradient.	Operational	40	■ The mine water management measures recommended during construction phase should continue during the operational phase; ■ It is recommended that abstraction from boreholes that are close to the mine workings should be avoided so that contaminants will not migrate away from the mine, towards the abstraction boreholes; ■ Divert surface flows away from the open pit areas through channels, drains and culverts; ■ Monitoring of groundwater quality and water levels is recommended (particularly down gradient of the mine site) with continuous refining and updating of	30

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
					the monitoring network based on the results obtained; ■ Annual audits of monitoring and management systems should be conducted by independent environmental consultants; and With the application of the above-stated mitigation plans, the impact of the contaminant migration during construction phase can be lowered to Negligible.	
Mine decant	Geohydrology	■ After the operational phase, the underground mine will be left to flood. Water level rise and inflows during the rebound period in any one compartment will be a function of only two features: ■ The total recharge to the compartment (i.e. the sum of rain-fed recharge and any head-dependent inflows from adjoining aquifers, and/or other compartment); and ■ The distribution of storage capacity within the compartment.	Closure/Post closure	68	■ Monitor water level rise and apply stage curves to assess the rate of flooding; ■ Seal mine shafts to prevent surface water from flowing into the defunct underground voids; ■ Seal all boreholes that connects the mine void to surface; ■ Monitor groundwater levels in boreholes in the surrounding aquifers to assess groundwater table responses; and ■ Groundwater monitoring should continue up to 5 years after closure.	33
Mine water contamination	Geohydrology	Contaminant migration away from the mine voids can only be induced by groundwater abstractions within the capture zone of the mine workings, and if decant occurs.	Closure/Post closure	56	■ No abstraction boreholes should be drilled in a 3 km radius from the underground workings in the post closure environment; ■ Perform effective rehabilitation and closure of redundant facilities through material placing and shaping, capping with appropriate capping liners and re-vegetation to prevent post closure infiltration through sources; and ■ Consider groundwater plume remediation only if post closure monitoring indicates a persistent pollution plume at unacceptable concentrations.	33
Mine decant	Geohydrology	After the operational phase all the pit will be left open. The groundwater table will rise again to its pre-mining position and water will accumulate in the pits due to cessation of dewatering. A pit lake will develop. Groundwater flow will be directed to towards the pit lake as evaporation from the pit water causes it to act as a groundwater sink. In addition to precipitation, surface water runoff from the surrounding area will flow to the pit and add to	Closure/Post closure	30	■ Monitor pit water level rise and apply stage curves to assess the rate of flooding; ■ Seal mine shafts to prevent surface water from flowing into the defunct underground voids; ■ Monitor groundwater level elevation in boreholes in the surrounding aquifer to assess groundwater table responses; and ■ Groundwater monitoring should continue up to 5	24

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		the rise of the pit lakes.			years after closure.	
Mine water contamination	Geohydrology	The final open pit, the waste dumps and old underground workings will be the major contamination sources in the post closure environment. The quality of groundwater in the post-closure environment will depend on background groundwater quality, the quality and quantity of surface water flowing into the pit and the geochemical processes that occur on the walls of the pit, above and below the pit lake.	Closure/Post closure	56	■ No abstraction boreholes should be drilled in 2.5 km radius from the pit in the post closure environment; ■ Perform effective rehabilitation and closure of redundant facilities through material placing and shaping, capping with appropriate capping liners and revegetation to prevent post closure infiltration through sources; and ■ Consider groundwater plume remediation only if post closure monitoring indicates a persistent pollution plume at unacceptable concentrations.	33
Loss of topsoil as a resource – open pit	Soils, Land Capability and Land Use	When vegetation is cleared and the topsoil is stripped, the soils natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Construction vehicles driving on these soils cause compaction reduces the soils ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	Construction	91	■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks); ■ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ■ The topsoil 0.3 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.7 – 0.9 m thick will then be stripped and stockpiled separately; ■ Soils to be stripped according to the rehabilitation soil management plan and stockpiled accordingly; ■ Foundation excavated soil should also be stockpiled; ■ Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for macro nutrients and pH; ■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; ■ Prevent unauthorised borrowing of stockpiled soil; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the	30

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
					ecological processes within the soil; ■ Soils will be stripped using the delineated soil types as guide. Yellow and red soils may be stripped together. Wetland soils (if allowed) should be stripped and stockpiled separately but also in the order topsoil (0.3 m) then subsoil separately; and ■ Access should be limited to prevent any unnecessary compaction from occurring.	
Hydrocarbon pollution	Soils, Land Capability and Land Use	When Hydrocarbons are spilled on a soil surface the soil becomes contaminated and therefor becomes toxic for plant growth.	Construction	90	■ Prevent any spills from occurring; ■ If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities; ■ All vehicles are to be serviced in a correctly bunded area or at an off-site location; and ■ Leaking vehicles will have drip trays place under them where the leak is occurring.	45
Loss of land capability	Soils, Land Capability and Land Use	Removal of soil layers will impact on the land capability because vegetation can no longer be supported.	Construction	84	■ No land capability mitigation is possible during the construction and operational phases because the land use is changed from agriculture to open pit; and ■ Mitigation of land capability post mining is required through legislation through land rehabilitation.	66
Loss of stockpiled topsoil as a resource	Soils, Land Capability and Land Use	Topsoil losses can occur during the operational phases as a result of rain water runoff and wind erosion, especially from roads and soil stockpiles where steep slopes are present.	Operational	91	■ Stockpiles are to be maintained in a fertile, vegetated, and erosion free state; ■ Stockpiles are to be clearly demarcated; ■ Ensure proper storm water management designs are in place; ■ Access routes are to be kept to a minimum as to reduce any unnecessary compaction from occurring; ■ If erosion occurs, corrective actions must be taken to minimize any further erosion from taking place; and ■ Unauthorised borrowing of stockpiled soil materials should be prevented.	30
Hydrocarbon pollution	Soils, Land Capability and Land Use	Hydrocarbon spills can impact soil quality.	Operational	90	■ Prevent any spills from occurring; ■ If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities; ■ All vehicles are to be serviced in a correctly bunded	45

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
					areas or at an off-site location; and Leaking vehicles will have drip trays place under them where the leak is occurring.	
Loss of land use and land capability	Soils, Land Capability and Land Use	Impact on the rehabilitation of soil, soil quality and land capability. Backfilling of soil layers will impact on the land capability by restoring the land capability to some extent because vegetation will be supported and therefore returned to the planned post mining land capability such as arable and or grazing.	Decommissioning	84	■ Mitigation is possible because the land use is changed from mining back to agriculture as follows: ■ The spoil should be shaped taking the pre-mining landscape into consideration; ■ The designed post mining landforms should be modelled to establish the post mining landscape stability by using a combination of GIS and erosion modelling techniques by a suitably qualified expert using site specific soil quality data; ■ The soil layers should be put back in the reverse order of stripping namely subsoil first then topsoil; ■ The yellow and red soils should be replaced in upland landscape positions; ■ Wetland soils should be put back in the reverse order of stripping; ■ Wetland soils should be placed in lower landscape positions; ■ The soil quality should be investigated prior to establishing vegetation on the rehabilitated soil through representative sampling and laboratory analysis; ■ The analytical data should be evaluated by a suitably qualified expert and vegetation fertility and or soil acidity problems should be corrected prior to vegetation establishment; ■ Clear targets incorporating medium to long term post mining land capability influencing land use, should be part of a potentially successful closure plan; and ■ From a national food security viewpoint, ways need to be found of rendering land rehabilitated to arable standards suitable for the economic production of cash crops.	60
The transportation of construction material to the project site via national, provincial and local roads	Visual	The transportation of construction material will have a negative visual impact on the receiving environment. Vehicular activity and the resulting dust will draw attention to the project area. These	Construction	28	■ Roads should be wetted frequently by means of a water bowser to suppress dust; and ■ Vehicles must be roadworthy and obey the	24

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		visual impacts are temporary and will only occur during the construction phase.			recommended speed limits at all times.	
Site clearance and topsoil removal prior to the commencement of physical construction activities across the project area	Visual	The removal of vegetation and topsoil for site clearing will have a negative visual impact on the receiving environment. The project area will become noticeable to the nearby receptors as it will contrast the surrounding areas.	Construction	66	■ Vegetation and topsoil should only be removed when and where necessary; and ■ Topsoil stockpiles should be vegetated.	55
The construction of waste rock dumps	Visual	Stockpiling waste rock will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.	Construction	66	■ Overburden should only be removed when and where necessary; ■ Reduce the height of overburden stockpiles where possible; ■ Limit the height and footprint area of overburden stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; and ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles.	55
The construction of topsoil stockpiles	Visual	Stockpiling topsoil will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.	Construction	66	■ Topsoil should only be removed when and where necessary; ■ Limit the height of soil stockpiles to 3 metres to prevent the soil from becoming compacted and to reduce the visual impact; ■ Topsoil stockpiles should be vegetated so as to blend into the surrounding landscape; ■ Limit the height and footprint area of topsoil stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; and ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles.	55
The establishment of the initial boxcut and access ramps to the open-pit mining areas	Visual	The establishment of the initial boxcut and access ramps to the open pit mining areas will have a negative visual impact on the receiving environment. Drilling and blasting to develop the initial boxcut for mining will result in noise and dust thereby attracting attention to the project area. The boxcut will dramatically contrast the surrounding	Construction	84	■ Only remove overburden when and where necessary; and ■ Apply dust suppression techniques to limit the dust created by blasting.	72

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		agricultural area. This will leave a scar on the landscape. Dust from the blasting will also have a negative visual impact. This visual impact will occur for the life of the project.				
The establishment of underground access shaft	Visual	The establishment of the underground access shaft will have a negative visual impact on the receiving environment. This visual impact will be negligible as the underground access shaft will be located within the open pit area.	Construction	24	■ Limit the height and footprint area of surface infrastructure where possible; ■ If surface infrastructure is to be painted, it should be painted natural hues so as to blend into the surrounding landscape where possible; and ■ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used.	18
The construction of haul roads on site	Visual	The construction of haul roads will have a negative visual impact on the receiving environment.	Construction	28	■ Do not create numerous haul roads alongside each other.	24
The construction of the access or service road	Visual	The construction of the access or service road will have a negative visual impact on the receiving environment.	Construction	20	■ Do not create numerous roads alongside each other.	15
The construction of the hard park area (this is made up of the workshop, office block and parking lot)	Visual	The construction of hard park area will have a negative visual impact on the receiving environment. This hard park area includes the workshop, office block and parking lot. These visual impacts will occur for the life of the project. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place. The visual impacts from the construction area lighting will occur during the construction phase.	Construction	42	■ Limit the height and footprint area of surface infrastructure where possible; ■ If the surface infrastructure is to be painted, it should be painted natural hues so as to blend into the surrounding landscape where possible; ■ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and ■ Avoid construction activities at night if possible, thereby avoiding the use of construction area lighting. If construction activities take place at night, down lighting should be implemented to minimise light pollution.	35
Drilling and blasting of the overburden rock for easy removal by excavators and dump trucks	Visual	The removal of overburden by drilling and blasting will have a continual negative visual impact on the receiving environment. Overburden stockpiling will have a negative visual impact on the receiving	Operational	84	■ Only remove overburden when and where necessary; ■ Plant fast-growing endemic vegetation in areas	72

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		environment. Dust from the blasting and from stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.			where it can conceal stockpiles; ■ Limit the height and footprint area of overburden stockpiles where possible; and ■ Apply dust suppression techniques to limit the dust created by blasting and from the stockpiles.	
Dumping of waste rock and maintenance of waste rock dump	Visual	Operation and maintenance of the waste rock dump will have a negative visual impact on the receiving environment. Dust from the dump will also have a negative visual impact on the receiving environment. These visual impacts will occur for the life of the project.	Operational	66	■ Overburden should only be removed when and where necessary; ■ Limit the height and footprint area of stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; and ■ Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.	55
Removal and loading of ore onto trucks (O/C) or conveyor (U/G) to the plant	Visual	The removal of ore will have a continual negative visual impact on the receiving environment. Infrastructure and mine area lighting will be visible at night resulting in a negative visual impact on the receiving environment. This visual impact will occur for the life of the project.	Operational	84	■ Limit the quantity and time of ROM stored on site; and ■ Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.	72
Vehicle movement on haul roads	Visual	Vehicular activity on the haul roads and access or service road will have a negative visual impact on the receiving environment. Dust from vehicular activity will also have a negative visual impact. These visual impacts will occur for the life of the project.	Operational	36	■ Do not create numerous haul roads alongside each other; ■ Roads should be wetted frequently by means of a water bowser to suppress dust; and ■ Vehicles must be roadworthy and obey the recommended speed limits at all times.	32
Continuing operation and maintenance of the stockpiles, including topsoil and ROM stockpiles	Visual	Operation and maintenance of the topsoil and ROM stockpiles will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact on the receiving environment. These visual impacts will occur for the	Operational	66	■ Topsoil should only be removed when and where necessary; ■ Limit the height of soil stockpiles to 3 metres to prevent the soil from becoming compacted and to reduce the visual impact;	55

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		life of the project.			■ Topsoil stockpiles should be vegetated so as to blend into the surrounding landscape; ■ Limit the height and footprint area of stockpiles where possible; ■ Apply dust suppression techniques to limit the dust from stockpiles; ■ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; ■ Limit the quantity and time of ROM stored on site; and ■ Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.	
Concurrent replacement of overburden and topsoil and the re-vegetation of mined out strips. The mined strip will be backfilled with overburden and compacted. Subsequently, the topsoil will be placed on top of the overburden and the area will be vegetated	Visual	Concurrent rehabilitation by replacement of overburden and topsoil as well as re-vegetation as mining progresses will have a neutral visual impact on the receiving environment. The aim of rehabilitation is to return the project area to a state similar to the pre-mining state. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment. Backfilling of the open pit with overburden will use rock removed from the void of the current mining strip to partly fill the mined out void in the previously mined strip. Once backfilling commences, overburden should no longer be added to the overburden stockpiles. This will have a neutral visual impact on the receiving environment. Spreading of topsoil and re-vegetation of the backfilled areas will have neutral visual impacts on the receiving environment.	Operational	84	■ Backfill as much of the open pit area as possible; ■ Spread topsoil over the backfilled area; and ■ Re-vegetate the backfilled area.	
Removal of surface infrastructure (plant machinery, shafts, conveyors)	Visual	Demolition and removal of infrastructure will have a neutral visual impact on the receiving environment. This will help to reverse some of the changes that occurred when the infrastructure was constructed.	Decommissioning	42	■ Ensure that all unnecessary infrastructure is demolished and removed from the site.	
Rehabilitation of roads and cleared areas (offices and	Visual	Rehabilitation of the roads and cleared areas by replacement of topsoil will have a neutral visual	Decommissioning	28	■ Ensure that the rehabilitated area is re-contoured	

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
workshop area)		impact on the receiving environment and will assist to return the project area to a state similar to the pre-mining state. Spreading of topsoil, and profiling and contouring to create a free-draining topography will have a neutral visual impact. Re-vegetation of the rehabilitated areas will have a neutral visual impact. These visual impacts will be permanent. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment.			■ and profiled to create a free-draining topography; ■ Spread topsoil over the rehabilitated area; ■ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; and ■ Re-vegetate the rehabilitated areas.	
Final placement of overburden and topsoil and the establishment of vegetation on the final opencast void. Overburden will be backfilled into the final void and compacted. Subsequently, topsoil will be placed and the area vegetated	Visual	Rehabilitation of the final open void (where possible) by replacement of overburden and topsoil will have a neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-mining state. Once ore has been removed from the open pit, there will be insufficient overburden to fill the void completely. Due to this material imbalance, a permanent void will remain. Spreading of topsoil, and profiling and contouring to create a free-draining topography will have a neutral visual impact. Re-vegetation of the rehabilitated areas will have a neutral visual impact. These visual impacts will be permanent. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment.	Decommissioning	84	■ Backfill as much of the final void as possible; ■ Ensure that the final void is as small as practically possible; ■ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ■ Spread topsoil over the rehabilitated area; ■ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; and ■ Re-vegetate the rehabilitated areas.	
Site clearance and construction activities	Noise	Mining machinery and vehicles is expected to increase ambient noise levels on site, but according to the dispersion models the noise levels are expected to be restricted to site. The negligible impacts are due to the noise not impacting on the surrounding sensitive receptors.	Construction	18	■ Restricting construction activities to daylight hours where viable; ■ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ■ Switching off equipment when not in use.	8
Drilling, blasting and operational activities	Noise	Mining machinery and vehicles is expected to increase ambient noise levels on site, but according to the dispersion models the noise levels are expected to be restricted to site. The negligible impacts are due to the noise not impacting on the	Operational	27	■ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ■ Switching off equipment when not in use.	14

Activity	Potential Impact	Aspects Affected	Phase	Significance (Pre-Mitigation)	Mitigation Type	Significance (Post-Mitigation)
		surrounding sensitive receptors.				
Demolition and removal of surface infrastructures and rehabilitation works	Noise	Mining machinery and vehicles is expected to increase ambient noise levels on site, but due to the limited activities the noise levels are expected to be restricted to site. The negligible impacts are due to the noise not impacting on the surrounding sensitive receptors.	Decommissioning	18	■ Restricting construction activities to daylight hours where viable; ■ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ■ Switching off equipment when not in use.	8
All noise causing activities have ceased during this phase	Noise	The noise impact during this phase will be neutral due to the expected ambient noise level returning to pre-mining baseline.	Closure/Post closure	63		

11 Item 3(j): Summary of specialist reports

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form):-

List of studies undertaken	*Prioritised* Recommendations of specialist reports (detailed mitigation measures are included in Part B)	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Air Quality Assessment	■ Ensure that air quality levels during the construction and operational phase comply with all relevant statutory standards, and that air quality impacts on surrounding sensitive receptors are minimised. ■ Adherence to the suggested mitigation measures outlined in this report is recommended in order to reduce anticipated impacts. ■ Start ambient air monitoring programmes i.e. PM_{10}. ■ The air quality impacts on the mine boundary are to be minimised to ensure compliance.	**X (detailed mitigation measures are included in Part B)**	Appendix G.
Fauna and Flora Assessment	■ Avoiding of sensitive habitats. ■ Rescue and relocation of sensitive fauna species. ■ Rescue and relocation of sensitive flora species.	**X (detailed mitigation measures are included in Part B)**	Appendix G.
Surface Water Assessment	■ Divert surface flows away from the open pit areas through channels, drains and culverts. ■ No mining or any operation should take place within a horizontal distance of 100 metres from any watercourse (GN, 704).	**X (detailed mitigation measures are included in Part B)**	
Geohydrological Assessment	■ It is recommended that abstraction from boreholes that are close to the mine workings should be avoided so that contaminants will not migrate away from the mine, towards the abstraction boreholes; ■ Minimise groundwater influx into pit through optimisation of mining layout to minimise structural disturbance. ■ Dewater aquifer prior to further underground excavations. Dewatering is more effective when operated very closely to the active mining face. ■ Implementation of water management system and groundwater monitoring system.	**X (detailed mitigation measures are included in Part B)**	
Soils, Land Use and Land Capability Assessment	■ The general best practice for soil stripping and stockpiling is to strip the top 0.3 m separately from the rest of the soil profile. ■ The soil should be stripped and stockpiled together to a maximum of 4 m (practical tipping height for dump trucks without	**X (detailed mitigation measures are included in Part B)**	Appendix G.

	the risk of compaction).		
Visual Impact Assessment	■ It is recommended that the mitigation measures detailed in the Visual Impact Report are implemented to reduce the impact that the proposed Lanxess Chrome Mine Expansion Project will have on the topography and visual character of the receiving environment. Vegetation and topsoil should only be removed when and where necessary to avoid exposing larger areas for longer periods of time which could result in soil erosion and increase the visual disturbance. ■ The most important mitigation aspect is the rehabilitation of the site. The success of this rehabilitation will influence the overall long term impacts of the project. The open pit should be filled with overburden. It is of utmost importance that the topography of the site be re-contoured and profiled to create a free-draining topography that resembles the pre-mining topography as closely as possible. It is also essential to reconstruct all pre-development surface water and drainage lines to ensure that a free-draining surface is created and that the surface water flow returns to its original state. After re-contouring and profiling the site, it should be covered with topsoil and re-vegetated to complete the rehabilitation process. ■ The stockpiles will stand out in the surrounding area and will have a long term visual impact. If the stockpiles could be spread to reduce the height, the visual impact could be reduced. In addition, rehabilitation (vegetating) of these large features can significantly reduce the visual impacts.	**X (detailed mitigation measures are included in Part B)**	Appendix G.
Noise Impact Assessment	The following with regards to blasting operations is recommended: ■ The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant; ■ Reduction of the powder factor, that is, use of less explosive per cubic yard of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed; and ■ Maintaining good public relations with the surrounding communities i.e. warning the local communities in advance before blasts.	**X (detailed mitigation measures are included in Part B)**	Appendix G.
Heritage Assessment	■ Exemption from further palaeontological assessments for the proposed infrastructure footprint is to be applied for as the palaeo-sensitivity is insignificant; ■ An HIA be undertaken that includes the following heritage	**X (detailed mitigation measures are included in Part B)**	Appendix G.

	components: ▪ An Archaeological Impact Assessment including reconnaissance to identify and record archaeological resources within the impact footprint; and ▪ An assessment of burial grounds and graves including reconnaissance to identify, record and document all burials that may exist in the impact footprint.		
Rehabilitation Plan	The following recommendations form part of the rehabilitation plan: ■ Should there is a change in the mining method, the hydrogeological impacts associated with the post closure environment should be remodelled; ■ A specific seed mix is recommended for revegetation of rehabilitated areas (refer to Rehabilitation Plan in Appendix H); ■ The Waste Rock dump should be shaped to an 18° slope; ■ The subsoil clay layers which can be found under certain hydromorphic soils need to be stripped and stockpiled separately; ■ There must be no planting of alien plants anywhere within the mining area; ■ Annual surveys, aimed at updating the alien plant list and establishing and updating the invasive status of each of the alien species, should be carried; and ■ The transportation of soils or other substrates infested with alien species should be strictly controlled.	**X**	Appendix G.

12 Item 3(k): Environmental Impact Statement

12.1 Item 3(k)(i): Summary of the Key Findings of the Environmental Impact Assessment

12.1.1 Air Quality Assessment

The pollutants TSP, PM_{10}, and $PM_{2.5}$ were assessed within the project boundary and on the 8 sensitive receptors. These were modelled using emissions from both the opencast and underground activities. The predicted PM_{10} annual level of 43 µg/m³ within the mine boundary will be in exceedance of the current standard. This can have adverse implications on the health of exposed mine workers if mitigation measure are not applied to bring this within compliance. The concentration predicted at all the selected sensitive receptors were all below the limit.

For $PM_{2.5}$, the annual level of 28 µg/m³ was experienced in the project boundary but the sensitive receptors were all below the limit. The levels $PM_{2.5}$ daily and annual are in exceedance within the mine boundary. Thus, the exposed workers are at risk due to daily exposure of this pollutant higher than the recommended limit.

In terms of dust deposition, deposition rates predicted for the different sensitive receptors were all below the 600 mg/m²/day. When the mitigation measures were implemented, the modelled dust fallout level in the project boundary reduced to 1 604 mg/m²/day and the anticipated fallout dust at the sensitive receptors reduced further.

12.1.2 Fauna and Flora Assessment

From the findings presented in the report, one can draw the conclusion that the portion of the open pit area that covers the agricultural area may go ahead and will have little to no impact on the natural vegetation and habitat types present. Similarly the underground areas will have no direct impact on the fauna and flora on the above surface. Small isolated pockets of sensitive areas (small koppie area) are found along the edges of the farm portion where the opencast operation will be based (seen in Figure 8-4). Mitigation measures have been provided to reduce the impact on these areas.

12.1.3 Surface Water Assessment

Although the study found no streams or any other water resources within the project area, the IWWMP compiled in 2010 indicated that excess water may only be discharged to the surrounding environment if it meets statutory requirements. It is important to note that blasting material during operational phases releases ammonium nitrates from the explosive residues. This chemical may contaminate the water to be discharged and can consequently contaminate nearby watercourses.

Mining activities have variety of impacts (quality and quantity) on the natural water resources. The extent and nature of impacts can range from minimal to significant depending on a range of factors associated with ongoing mining processes as well as post mining management of the affected environment. Therefore, certain recommendations for the proposed Lanxess underground extensions and opencast mine have been made as mitigation measures for the identified potential surface water impacts.

12.1.4 Geohydrology Assessment

The worst case zone of influence is predicted to extend 2.5 km from the pit centre. The syenite dyke east of the pit is reportedly impermeable; hence the aquifers on the opposite site of the dyke are not expected to be influenced by mining of the proposed pit and private users will not be impacted.

In the weathered aquifer, underground mining in the new segments is not expected to cause additional dewatering, no more than already impacted. As groundwater is used on ad hoc basis, the impacts on groundwater quantity during the operational phase of the underground sections (current and proposed) is not seen to be significant.

In terms of groundwater quality, chromium levels in groundwater are below detection limits. The general groundwater body has elevated and non-compliant magnesium levels. Specifically, the current impacts on groundwater quality around the proposed pit lies in the vicinity of the old underground workings at Makuku informal settlement.

12.1.5 Soils, Land Capability and Land Use Assessment

The dominant land capability for the area is the Class III (Moderate cultivation/ Intensive grazing) capability (373.77 ha), with the Class VIII (Wilderness) capability (10.32 ha) in the north-western portion, corresponding with the ecological sensitivity for the opencast area. The Class VIII capability was found on the steeper sloped soils with shallow soil depth. The development of this cultivated area will result in the irreplaceable loss of agricultural land.

12.1.6 Noise Assessment

Based on the national noise control regulations, whereby disturbing noise means a noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more, it is concluded that the proposed mining activities will not impact on the surrounding areas.

12.1.7 Visual Assessment

The proposed Lanxess Chrome Mine Expansion Project will have a negative visual impact on the receiving environment. The greatest visual impact will be from the open pit, overburden and topsoil stockpiles as these cover a large area. The height of the overburden and topsoil stockpiles will also increase the visual impact. The construction of surface

infrastructure will have a lesser visual impact as it only covers a small part of the project area.

12.1.8 Heritage Assessment

Stone Age material has been identified throughout the local study area and reported on in other relevant heritage studies. A few weathered examples were found to the north of the proposed open pit. These lithics are often identified in isolation and outside of discernible context, therefore providing limited scientific information beyond form, function and technique of manufacture.

The local study area contains a large number of LIA stone-walled settlements. A large LIA stone-walled settlement was identified just to the north of the proposed open pit and additional associated stone-walling to the east within the pit.

12.2 Item 3(k)(ii): Final Site Map

Please refer to Appendix 4 for the site map at an appropriate scale which superimposes the proposed overall activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers.

As a result of sensitive areas found on the eastern boundary of the site it has been recommended by Digby Wells that the layout of the proposed stockpile be amended. By reshaping the stockpile the footprint size and capacity will remain the same however a 100m buffer zone will be included around the water course. The implementation of this buffer zone as a mitigation measure will reduce the impact of construction and operation on the fauna and flora in this sensitive area. Please refer to the “Recommended Opencast Infrastructure” plan under Appendix F.

12.3 Item 3(k)(iii): Summary of the Positive and Negative Implications and Risks of the Proposed Activity and Identified Alternatives

Please refer to Section 8.7 above for a list of positive and negative implications (and relevant risks) of the proposed activity(ies).

13 Item 3(l): Proposed Impact Management Objectives and the Impact Management Outcomes for Inclusion in the EMPR

The environmental and social objectives are set to allow the mining of the chrome resource in an environmental and socially responsible fashion while ensuring that sustainable closure can be achieved. To achieve closure the correct decisions need to be taken during the planning phase of the project.

13.1 Environmental Objectives and Goals

The environmental objectives for the construction and operational phases are to:

- Protect the biophysical environment from any impacts that cannot be mitigated and that will negatively impact on biodiversity on a regional scale;
- Reserve the water resources in line with the objectives of the integrated catchment management and thereby ensure that the limited available resources are utilised to the maximum benefit of the country and its inhabitants;
- To ensure that activities are carried out so as to aid rehabilitation;
- To ensure a safe environment for people to live in as is stipulated in the constitution.

13.2 Socio-economic Objectives and Goals

The following socio-economic objectives should be attained during the construction, operation, and decommissioning phases of the Lanxess mining operations.

- Adhere to an open and transparent communication procedure with stakeholders at all times.
- Ensure that accurate and regular information is communicated to IAPs.
- Ensure that information is communicated in a manner which is understandable and accessible to IAPs.
- Enhance project benefits and minimise negative impacts through intensive consultation with stakeholders.
- Assemble adequate, accurate, appropriate, and relevant socio-economic information relating to the context of the operation.
- Ensure that recruitment strategies for the mine, prioritise the sourcing of local labour, and share in gender equality.
- Ensure an atmosphere of equality and non-discrimination among the workforce.
- Contribute to the development of functional literacy and numeracy among employees.
- Empower the workforce to develop skills that will equip them to obtain employment in other sectors of the economy.
- Contribute to the development of a self-reliant (not dependent on the mine) community surrounding the area of operation.
- Ensure that decommissioning and retrenchments take place in a legally compliant and humane manner.
- Adhere to principles of international best practice in all socio-economic activities.

13.3 Historical and Cultural Aspects

Sites of historical and cultural significance will have to be removed or relocated before the onset of mining operations. The objective is to encourage the preservation of cultural structures not affected by mining.

14 Item 3(m): Final Proposed Alternatives

As the chrome reserve is limited to the preferred site, no property alternatives have been considered as the envisaged mining operations will occur on properties already utilised for the mining operations (for which Lanxess holds the mining rights), or on properties that the Mine currently own or on mining areas that Lanxess is in the process of acquiring through a Section 11 transfer process as detailed in the Introduction (Section 1).

No alternatives to the mining of chrome have been considered as this application deals with the expansion of the current operations which mine chrome.

The site layout in terms of the position of the haul and service roads, waste rock dump and topsoil stockpile was determined by considering both spatial and practical mining operation aspects. As such, various options would have been considered during the planning phase in order to derive an optimal layout.

The site layout in terms of the position of the haul and service roads, waste rock dump and topsoil stockpile was determined by considering both spatial and practical mining operation aspects. As such, various options would have been considered during the planning phase in order to derive an optimal layout.

The “no-go” option for implementing the activity has been considered, but due to the fact that the mining of the remaining resources will lead to job creation and continued contribution to the GDP of not only the municipality, but also the Province as a whole, this option will not be pursued.

15 Item 3(n): Aspects for Inclusion as Conditions of Authorisation

No additional aspects have been considered for inclusion into the conditions for the Environmental Authorisation.

16 Item 3(o): Description of any Assumptions, Uncertainties and Gaps in Knowledge

16.1 Assumptions, Uncertainties and Knowledge Gaps Relating to the Air Quality Study

Data limitations and assumptions associated with the air quality study include:

- The impact assessment was limited to particulates $PM_{2.5}$, PM_{10}, and dust fallout;
- This assessment did not include tail pipe emissions from vehicles; and

- US-EPA and NPi emission factors for mining were utilised in this assessment due to the unavailability of local emission factors.

16.2 Assumptions, Uncertainties and Knowledge Gaps Relating to the Fauna and Flora Study

As the sampling of the entire study area is not feasible, representative samples of the vegetation were assessed. The vegetation was classified according to available aerial imagery as well as through an initial site inspection. The number of sample sites visited was determined by the time available for the study as well as the accessibility of each of the sample sites. Then, areas of each vegetation type classified before going to site were randomly sampled. This methodology allowed for more efficient sampling other than overall random sampling.

There is a method for determining the number of plots required for a statistically accurate sample for each vegetation type. However, time limitations did not allow for such complete sampling. The result is the sampling of as many plots as possible in each predetermined vegetation type.

16.3 Assumptions, Uncertainties and Knowledge Gaps Relating to the Geohydrological Study

16.3.1 Numerical Model Limitations and Assumptions

Numerical models are commonly used to develop hydrogeological management solutions that include the prediction of contaminant plume migration and groundwater level changes over time. However, groundwater systems are often complex and the data input requirement is beyond our capability to evaluate in detail. A model, no matter how sophisticated, will never describe the investigated groundwater system without deviation of model simulations from the actual physical process (Spitz, 1996). Therefore, it is necessary to make several simplifying assumptions to simplify the complex, real world hydrogeological conditions into a simplified, manageable model. The following are the assumptions and limitations of the model:

- The model is a regional scale model and encompasses a wide area around Lanxess Chrome Mine to determine hydrogeological interaction between the mine site and surrounding regional groundwater systems;
- The current geological information is sufficient to describe the extent of the different aquifers;
- Site specific (intrusive) hydrogeological studies have not been carried out in the proposed segments, as such aquifer parameters that cover tested areas are assumed for areas with no site details;
- The regional dyke system separating the catchments is modelled as a no-flow boundary;

- Faults and fractures are not explicitly modelled. The assumption that a fractured aquifer will behave as a homogeneous porous medium can lead to error. However, on a large enough scale (bigger than the REV, Representative Elemental Volume) this assumption should be acceptable;
- The model does not incorporate detailed historical mining. The underground mine voids at Wonderkop are represented, but the simulation does not include details on the timeline;
- The spatial distribution and amount of natural and artificial recharge is uncertain. So a uniform recharge is used to avoid over-complication of the model;
- A recharge rate of 50 mm/a is used for all slimes dumps adjacent to the existing and proposed Lanxess mining operations; and

The complexities of fractured rock aquifers imply that the model can only be used as a guide to determine the order of magnitude of dewatering and contaminant transport.

16.4 Assumptions, Uncertainties and Knowledge Gaps Relating to the Heritage Study

The following restrictions and limitations were encountered:

- The heritage report is primarily desktop based – field work was limited to a screening site visit undertaken over 1 day and focused on the proposed infrastructure footprint;
- The report is not intended to present an exhaustive list and description of heritage resources;
- The purpose of the screening site visit was to visually document the current conservation status of the cultural landscape, and to ground-truth certain tangible heritage resources identified in the literature review. The screening survey did not use systematic, controlled survey techniques, nor was it intended to be a comprehensive survey of the proposed project area;
- Desktop findings are based on available research from credible sources. While every attempt to obtain the latest available information was made, reviewed literature does not represent an exhaustive list of information sources for the study area;
- Time constraints did not allow the heritage specialists to engage any stakeholders in respect of heritage resources; and
- Many tangible heritage resources, specifically archaeological resources, commonly occur below the visible surface, and may not be adequately recorded, documented and assessed without intrusive and destructive methods. Such investigations are outside the scope of the specialist report and the consequent HIA, as well as beyond the requirements to conduct a HIA in terms of the NHRA.

17 Item 3(p): Reasoned Opinion as to whether the Proposed Activity should or should not be Authorised

17.1 Item 3(p)(i): Reasons why the Activity should be Authorised or Not

The Mine has a reputation for being a supplier of high quality chrome ore to various businesses. Lumpy (metallurgical ore) is sold the ferrochrome industry where it is processed with coal in an electric furnace to form ferrochrome, which, in turn, is the master alloy used in the production of a wide range of corrosion and heat resistant stainless steel. Foundry grade chrome ore is used for the manufacture of casting moulds in foundries. The same material is also used in the production of refractory materials. And finally, chemical grade chrome ore is the raw material for the production of sodium dichromate processed by Lanxess in their other operations (chemical plants), which is the main constituent of all chrome chemicals. Chrome chemicals are used, for example, as leather tanning agents.

The continuation of the Mine to produce and supply the various grades of chrome ore to a wide spectrum of industrial and commercial establishments will benefit the GDP of not only the municipality, but also the Province as a whole.

Finally, as stated in the MPRDA, the Government's objective is to maximise the benefit of the nation's mineral resources for the benefit of all South Africans. By continuing producing chrome ore by way of expanding Lanxess's mining operations, this objective can be accomplished, particularly through job creation.

17.2 Item 3(p)(ii): Conditions that must be Included in the Authorisation

17.2.1 Specific Conditions to be Included into the Compilation and Approval of EMPR

No specific conditions, other than the mitigation measures as set out in the EMP, have been considered as part of the compilation and approval of the EMPR.

17.2.2 Rehabilitation Requirements

The rehabilitation requirements, as set out in the rehabilitation plan attached under Appendix G, is to be adhered to.

18 Item 3(q): Period for which the Environmental Authorisation is Required

Based in the LoM and considering various aspects that may delay mining operations, the period for which environmental authorisation is required is estimated at 25 years.

19 Item 3(r): Undertaking

The undertaking required to meet the requirements of this section is provided and is applicable to this Section 102 amendment report as well as the environmental management programme report.

20 Item 3(s): Financial Provision

The closure liability only focused on the proposed mining activities and the cost for rehabilitation and closure of the proposed site according to the DMR Guideline format is R 39 496 122.47.

20.1 Item 3(s)(i): Explain how the Aforesaid Amount was Derived

Closure liability costs were calculated by means of the DMR's standard method for assessment of mine closure (please refer to the Closure and Liability Report under Appendix G).

20.2 Item 3(s)(ii): Confirm that this Amount can be Provided for from Operating Expenditure

Confirmation is hereby given that the amount is anticipated to be an operating cost and is provided for as such in the mining work programme.

21 Item 3(t): Deviations from the Approved Scoping Report and Plan of Study

21.1 Item 3(t)(i): Deviations from the methodology used in determining the significance of potential environmental impacts and risks

Not applicable, this application relates to a Section 102 amendment process which did not include a Scoping Phase.

21.2 Item 3(t)(ii): Motivation for the Deviation

Not applicable, this application relates to a Section 102 amendment process which did not include a Scoping Phase.

22 Item 3(u): Other Information Required by the Competent Authority

22.1 Item 3(u)(i)(1): Impact on the Socio-Economic Conditions of any Directly Affected Person

No impacts on the socio-economic conditions of any directly affected person have been identified.

22.2 Item 3(u)(i)(2): Impact on any National Estate Referred to in Section 3(2) of the National Heritage Resources Act

Considering the regional geology and paleontological sensitivity, the site specific study area has no significance. All three Stone Age periods have been recorded in the regional study area and throughout the Limpopo Province: Early Stone Age (ESA, ca. 3 Ma to 300 Ka), Middle Stone Age (MSA, ca. 300 Ka to 30 Ka) and Later Stone Age (LSA, ca. 30 Ka to 2000 years ago). Several assessment studies have identified weathered MSA tools, however these were mostly found out of context.

Ceramic shards and stone walled settlements were identified during the scoping survey of the project area, as well as in several archaeology and heritage studies previously completed in the region. The ceramics provide evidence of Iron Age settlement from at least the 17th century CE continuing to the 19th century CE. This is consistent with the regional study area.

A mine shaft that was sunk in 1949 was recorded during the scoping survey; however it was in operation until 1979. A total of two graves have been recorded in the surrounding areas during previous heritage assessments.

23 Item 3(v): Other Matters Required in terms of Sections 24(4)(a) and (b) of the Act

Please refer to Sections 8 and 14 of Part A for the motivation for not having assessed reasonable or feasible alternatives.

Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

Ms Aken holds the following degrees/diplomas (please refer to Appendix A):

- BSc Zoology and Entomology, Rhodes University, 2003;
- BSc Hons, Rhodes University, 2004;
- Post-grad diploma in Environmental Science, Wits University, 2014; and
- Registered with EAPSA.

Please refer to Part A: Sections 2.1 and 2.2 as well as Table 2-1 for details of the EAP and his/her expertise.

2 Item 1(b): Description of the Aspects of the Activity

Please refer to Part A: Section 10 for a description of the aspects of the relevant activities covered as part of the EMPr.

3 Item 1(c): Composite Map

Please refer to Appendix 3, Plan 5, for the Composite Map.

4 Item 1(d): Description of Impact Management Objectives Including Management Statements

4.1 Item 1(d)(i): Determination of Closure Objectives

The rehabilitation of Lanxess Chrome Mine will require significant levels of control and monitoring during implementation if the desired objectives are to be achieved. These closure objectives have been derived with the use of the baseline in Section A. In brief, these objectives are:

- Produce a free draining, and stable topography (landscape);
- Ensure erosion free, sustainable vegetation;
- Return rehabilitated land-use to the pre-mining environment where possible;
- Minimise negative impacts and maximise positive benefits on the local community;
- Follow a comprehensive consultation and communication process with all stakeholders.
- Prevent soil and surface/groundwater contamination by managing all water on site to acceptable and agreed standards; and

Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure.

Please refer to Section 7 for a breakdown of the closure objectives.

4.2 Item 1(d)(ii): The Process for Managing any Environmental Damage, Pollution, Pumping and Treatment of Extraneous Water or Ecological Degradation as a Result of Undertaking a Listed Activity

4.2.1 Sewage Plant

A sewage treatment facility is located on site to chemically treat the sewage produced from the living quarters and working sites.

4.2.2 Pollution Control Dams, Paddocks and Evaporation Dams

Return water dams are used to collect polluted water from the tailings dam facility and water is recycled from this facility and through the process again.

4.2.3 Polluted Water Treatment Facility

No additional polluted water treatment facility is currently necessary as existing dams will be utilised. Polluted water is kept separate from the clean water according to Regulation 704 of the Government Gazette 20118, 4 June 1999. At the tailings dam this separation is achieved through the construction of a clean water bypass berm that directs the clean water away from the tailings dam, while the polluted water is directed to one of the return water dams. All stockpiles are bunded. Water from the return water dams is recycled for use in the mining operations.

4.2.4 Potable Water Treatment Facility

No potable water treatment facility is required. Potable water is supplied by Rand Water.

4.2.5 Process Water Supply System

An additional process water dam with the capacity of 17 500 m^3 has been constructed downstream of the existing process water dam (which holds 6 300 m^3).

4.3 Item 1(d)(iii): Potential risk of Acid Mine Drainage

The potential for acid generation is based on an earlier review of the sulphur species concentrations, carbonate values, the AP, NP and Net NP values and the NP/AP ratios. When considering this summary it is important to keep in mind that the Modified ABA test method provides *an indication* of the potential for acid generation. Whether or not acidic drainage will result is largely a function of the mineralogy, the availability of each acid generating and neutralising mineral present, the physical characteristics of the material and the environmental setting. All of the samples can be classified as having a Medium Neutralising Potential. The medium neutralising potential and absence of sulphur and therefore acid generation potential indicates that no AMD will be formed. Neutral pH, with a high TDS drainage will also not occur as no first step in the acidification occurs. Neutral Mine Drainage (NMD) is characterised by acidification followed by an adequate buffering capacity

to result in a neutral pH, but high salinity from the release of sulphates, acidification and resultant neutralisation by carbonate minerals.

4.4 Item 1(d)(iv): Steps taken to Investigate, Assess, and Evaluate the Impact of Acid Mine Drainage

In an earlier study, six samples were collected for ABA analyses from borehole GC5 on site to determine the potential for AMD formation. Five samples represented the overburden with the sixth sample being a composite from ore material to determine if there are major differences in the chemical properties of the two.

4.5 Item 1 (d)(v): Engineering or Mine Design Solutions to be Implemented to avoid or Remedy Acid Mine Drainage

The Lanxess Chrome Mine is not currently considered to have an impact on acid mine drainage in the area and therefore no additional engineering has been undertaken.

4.6 Item 1(d)(vi): Measures that will be put in place to Remedy any Residual or Cumulative Impact that may result from Acid Mine Drainage

Additional measures would include those included for the management of decant or the separation of dirty water from the current operations.

4.7 Item 1(d)(vii): Volumes and rate of water use required for the mining, trenching or bulk sampling operation

The mine does not utilise water from any local surface water resources for its activities, with Rand Water being the primary supplier of water to the mine. The water make up requirements are approximately 1 000 m^3/ day. Below is a summary of the water requirements for the mine.

- The water in circulation is estimated to be 175 000 m^3/month, of which most is recycled.
- The HMS plant uses 40% of the total water consumption (70 000 m^3/month).
- The gravity plant uses 60% of the water consumption (105 000 m^3/month).
- The mine's domestic consumption averages 8 200 m^3/month (IWWMP, 2010).

4.8 Item 1(d)(viii): Has a water use licence has been applied for

An existing Water Use Authorisation was granted in 2005. An amendment to the current Water Use Licence (WUL) was submitted in 2011 and again is currently being updated by Digby Wells.

4.9 Item 1(d)(ix): Impacts to be Mitigated in their Respective Phases

Please refer to Table 6-1 for a summary of impacts to be mitigated in their respective phases.

5 Item 1(e): Impact Management Outcomes

Please refer to Table 6-1 for a summary of impact management outcomes.

6 Item 1(f): Impact Management Actions

Please refer to Table 6-1 for a summary of impact management actions.

Table 6-1: Summary of impacts to be mitigated in their respective phases

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
1) The transportation of construction material to the Project site via national, provincial and local roads.	Construction for Underground and Opencast Operations	Mining machinery and vehicles may increase ambient noise levels at surrounding urban and rural noise sensitive receptors. The transportation of construction material will have a negative visual impact on the receiving environment. Vehicular activity and the resulting dust will draw attention to the project area. These visual impacts are temporary and will only occur	Increase in Noise levels. Negative visual impact.		▪ Restricting construction activities to daylight hours where viable; ▪ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use. ▪ Roads should be wetted frequently by means of a water bowser to suppress dust; and ▪ Vehicles must be roadworthy and obey the recommended speed limits at all times.	Recommended noise control measures (as recommended in previous column). Recommended visual mitigation measures (see previous column).	Noise levels will be kept to a minimum. There are no national standards for visual.	The expected noise levels from the proposed project will comply with the National Noise Control Regulations.	Construction Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		during the construction phase.							
2) Storage of fuel, lubricant and explosives in temporary facilities for the duration of the construction phase.		Impacts on surface water quality as a result of accidental spillages of hazardous substances from construction vehicles used during site clearing and grubbing. Impact on soil quality from hydrocarbon spills. Groundwater contamination. The temporary storage of fuel, lubricants and explosives will have a negative visual impact on the receiving environment. These visual impacts are temporary and will only occur during the construction phase.	Surface water contamination. Hydrocarbon spills. Potential decrease in groundwater quality. Negative visual impact.	>1ha	▪ Prevent any spills from occurring; ▪ If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities; ▪ All vehicles are to be serviced in a correctly bunded area or at an off-site location; and ▪ Leaking vehicles will have drip trays place under them where the leak is occurring. ▪ Implement and train drivers to adhere to traffic rules; ▪ Implement a vehicle maintenance schedule; ▪ Install oil collection pans under vehicles; ▪ Handle and store blasting material according to manufacturing requirements; ▪ Minimise external contamination sources in the pit (diesel, oils, chemicals) as far as possible to ensure that groundwater flowing into the mine is contaminated; and ▪ Monitor quality of mine water. ▪ Limit the footprint area of temporary storage facilities where possible.	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Project Life Construction Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
3) Site clearance and topsoil removal prior to the commencement of physical construction activities across the project area.		Removal of soil layers will impact on the land capability because vegetation can no longer be supported. Increase in turbidity of surface water runoff during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles which is high in suspended solids. Removal of vegetation. Impact on unidentified heritage resources. The removal of vegetation and topsoil for site clearing will have a negative visual impact on the receiving environment. The project area will	Loss of land capability. Increase in turbidity in water affecting the water quality. Increase in levels of TSP, PM10 and PM2.5. Reduction in vegetation. Damage to unidentified heritage resource. Negative visual impact.	100-200ha	▪ The construction phase should be limited to the dry months of the year (May-October) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing and grubbing; ▪ The removed topsoil should be covered or vegetated as soon as possible to prevent sediment erosion; ▪ No land capability mitigation is possible during the construction and operational phases because the land use is changed from agriculture to opencast; and ▪ Mitigation of land capability post mining is required through legislation through land rehabilitation. ▪ Clearing of vegetation should be limited to the project site, and the use of existing access roads should be prioritized so as to avoid construction of new access roads in these areas; ▪ Site clearing should be carried out in non-windy months ▪ Water should be used to dampen dust generating areas during the clearing process ▪ Avoid sensitive landscapes such as the Koppies that were encountered on site. ▪ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ▪ Maintain top soil biological activity by soils stockpiling without compaction to	control through management and monitoring. Recommended visual mitigation measures (see previous column).	NWA, DWS BPG Ambient air quality standard operating procedure including monitoring programme. There are no national standards for visual.	Impact avoided/ minimised.	Construction Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		become noticeable to the nearby receptors as it will contrast the surrounding areas.			keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used. ▪ A study to identify and record burial grounds and archaeological resources. ▪ A Heritage 'watch-out' during construction. ▪ Vegetation and topsoil should only be removed when and where necessary; and ▪ Topsoil stockpiles should be vegetated to reduce visual disturbance where possible.				
4) The construction of waste rock dumps.		Increase in turbidity of surface water runoff during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles which is high in suspended solids Removal of vegetation Unidentified heritage resources. Stockpiling waste rock will have a negative visual	Decrease in water quality Decrease in vegetation cover Damage to heritage resources. Negative visual impact.	100-200ha	▪ The construction phase should be limited to the dry months of the year (May-October) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing and grubbing ▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the rock dump within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ▪ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ▪ Maintain top soil biological activity by soils stockpiling without compaction to	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	NWA, DWS BPG. There are no national standards for visual.	Impact avoided/ minimised.	Construction Phase Project Life

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.			keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used. ▪ A study to identify and record burial grounds and archaeological resources. ▪ A Heritage 'watch-out' during construction. ▪ Overburden should only be removed when and where necessary; ▪ Overburden stockpiles should be positioned to reduce visual disturbance where possible; ▪ Reduce the height of overburden stockpiles where possible; ▪ Limit the height and footprint area of overburden stockpiles where possible; ▪ Apply dust suppression techniques to limit the dust from stockpiles; ▪ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; and ▪ Ensure vegetation screens are built and maintained.				
5) The construction of topsoil stockpiles.		Increase in turbidity of surface water runoff during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles which is high in	Loss of Topsoil as a resource Increase in run-off and turbidity. Impact on water quality from runoff Increase in levels of TSP,	50-100ha	▪ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ▪ Stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks); ▪ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ▪ The topsoil 0.3 m of the soil profile should be stripped first and stockpiled separately; ▪ The subsoil approximately 0.7 – 0.9 m	control through management and monitoring. Recommended visual mitigation measures (see previous column).	NWA, DWS BPG NEMAQA. There are no national standards for visual.	Impact avoided/ minimised Within Air Quality Guidelines	Construction Phase Project Life

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		suspended solids. Impact on soil through removal and stockpiling of soil. Impact on water quality from runoff Removal of vegetation cover. Stockpiling topsoil will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.	PM10 and PM2.5 Loss of vegetation. Negative visual impact.		thick will then be stripped and stockpiled separately; ▪ Soils to be stripped according to the rehabilitation soil management plan and stockpiled accordingly; ▪ Foundation excavated soil should also be stockpiled; ▪ Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for macro nutrients and pH; ▪ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ▪ Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; ▪ Prevent unauthorised borrowing of stockpiled soil; ▪ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ▪ Soils will be stripped using the delineated soil types as guide. Yellow and red soils may be stripped together. Wetland soils (if allowed) should be stripped and stockpiled separately but also in the order topsoil (0.3 m) then subsoil separately; and ▪ Access should be limited to prevent any unnecessary compaction from occurring ▪ The removed topsoil should be covered or vegetated as soon as possible to prevent sediment erosion				

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
					(details contained in rehabilitation plan) ▪ Water sprays can be utilised to reduce the levels of particulate matter. ▪ Drop heights should be reduced ▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the topsoil stockpiles within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ▪ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ▪ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used. ▪ Topsoil should only be removed when and where necessary; ▪ Limit the height of soil stockpiles to 3 metres to prevent the soil from becoming compacted and to reduce the visual impact; ▪ Topsoil stockpiles should be vegetated so as to blend into the surrounding landscape; ▪ Topsoil stockpiles should be positioned to reduce visual disturbance where possible; ▪ Limit the height and footprint area of topsoil stockpiles where possible;				

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
					▪ Apply dust suppression techniques to limit the dust from stockpiles; ▪ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; and ▪ Ensure vegetation screens are built and maintained.				
6) The establishment of the initial boxcut and access ramps to the open-pit mining areas.		Impacts on Air Quality during the development of the boxcut Removal of vegetation Potential dewatering. The establishment of the initial boxcut and access ramps to the open pit mining areas will have a negative visual impact on the receiving environment. Drilling and blasting to develop the initial boxcut for mining will result in noise and dust thereby attracting attention to the project area. The boxcut will dramatically	Increase in levels of TSP, PM10 and PM2.5 Loss of vegetation cover Decrease in water quantity. Negative visual impact.	>1ha	▪ Water should be used to dampen dust generating areas ▪ Avoid the establishment during windy months ▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the topsoil stockpiles within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ▪ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ▪ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used. ▪ Establish the depth to groundwater table prior to construction; ▪ Minimise penetration into the groundwater table; ▪ If groundwater table is to be penetrated to significant depth,	Recommended visual mitigation measures (see previous column).	There are no national standards for visual.		Project Life

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		contrast the surrounding agricultural area. This will leave a permanent scar on the landscape. The visual impact of the boxcut and access ramps will be permanent and irreversible. Dust from the blasting will also have a negative visual impact. This visual impact will occur for the life of the project.			dewater aquifer prior to excavations; ▪ Depending on the quality of the groundwater, discharge, store or recycle as appropriate; and ▪ Obtain permission from regulating authority. ▪ Only remove overburden when and where necessary; and ▪ Apply dust suppression techniques to limit the dust created by blasting.				
7) The establishment of underground access shaft.		Impacts on Air Quality during the development of the shaft Impact on groundwater quality and quantity. The establishment of the underground access shaft will have a negative visual impact on the receiving environment.	Increase in levels of TSP, PM10 and PM2.5 Potential dewatering due to minor seepage Potential chemical contamination from blasting. Negative visual impact.	>1ha	▪ Water should be used to dampen dust generating areas ▪ Avoid the establishment during windy months ▪ Undertake groundwater intrusive investigation around the shaft to optimise the position of the shaft and associated infrastructure to avoid major water bearing features; ▪ Handle and store blasting material according to manufacturing requirements; ▪ Establish the depth to groundwater table prior to construction; ▪ Grout or pump out any significant inflow of groundwater during shaft	Recommended visual mitigation measures (see previous column).	There are no national standards for visual.		Project Life

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		This visual impact will be negligible as the underground access shaft will be located within the open pit area.			construction to ensure a dry and safe working environment; ▪ Depending on the quality of the groundwater, discharge, store or recycle as appropriate; and ▪ Monitor quality of mine water. ▪ Limit the height and footprint area of surface infrastructure where possible; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; and ▪ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used.				
8) The construction of haul roads on site		Impacts on surface water quality as a result of accidental spillages of hazardous substances from construction vehicles used during site clearing and grubbing Removal of vegetation cover Impact on unidentified heritage resources.	Decrease in water quality Loss in vegetation Damage to heritage resources. Negative visual impact.	30-40ha	▪ Haul roads need to be well compacted to avoid erosion of the soil into the stream ▪ Water sprays on the road should be used frequently during construction. ▪ The use of existing access roads should be prioritized so as to avoid construction of new access roads in these areas; ▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the topsoil stockpiles within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ▪ Restrict nationally restricted alien invasive plant recruitment by ensuring	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Construction Phase Project Life

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		The construction of haul roads will have a negative visual impact on the receiving environment.			the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ▪ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated A study to identify and record burial grounds and archaeological resources. ▪ A Heritage 'watch-out' during construction areas where these soils are used. ▪ Do not create numerous haul roads alongside each other.				
9) The construction of the access or service road.		Impacts on surface water quality as a result of accidental spillages of hazardous substances from construction vehicles used during site clearing and grubbing Loss in vegetation. The construction of the access or service road will have a negative visual impact on	Decrease in water quality Decrease in vegetation cover. Negative visual impact.	20-30ha	▪ Access roads need to be well compacted or surfaced correctly to avoid erosion of the soil into the stream ▪ the use of existing access roads should be prioritized so as to avoid construction of new access roads in these areas; ▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the topsoil stockpiles within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ▪ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Construction Phase Project Life

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		the receiving environment.			minimised thereby reducing the risk of open areas occurring. ▪ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent basis for rehabilitated areas where these soils are used. ▪ Do not create numerous roads alongside each other.				
10) The construction of the hard park area (this is made up of the workshop, office block and parking lot).		Removal of soil layers will impact on the land capability because vegetation can no longer be supported. The construction of hard park area will have a negative visual impact on the receiving environment. This hard park area includes the workshop, office block and parking lot. These visual impacts will occur for the life of the project. Construction area lighting at	Loss of land capability Loss of vegetation cover. Negative visual impact.	1ha-2ha	▪ The construction phase should be limited to the dry months of the year (May-October) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing and grubbing; ▪ The removed topsoil should be covered or vegetated as soon as possible to prevent sediment erosion; ▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the topsoil stockpiles within the low sensitivity agricultural fields. Re-vegetate open areas to limit erosion. ▪ Restrict nationally restricted alien invasive plant recruitment by ensuring the removal of vegetation during construction and operation will be minimised thereby reducing the risk of open areas occurring. ▪ Maintain top soil biological activity by soils stockpiling without compaction to keep the seed bank viable if topsoil is replaced within a year. This viable seedbank will create an excellent	Recommended visual mitigation measures (see previous column).	There are no national standards for visual.		Construction Phase Project Life

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place. The visual impacts from the construction area lighting will occur during the construction phase.			basis for rehabilitated areas where these soils are used. ▪ Limit the height and footprint area of surface infrastructure where possible; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; ▪ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; ▪ Construction of vegetation berms must be implemented close to infrastructure so that vegetation can be established; and ▪ Avoid construction activities at night if possible, thereby avoiding the use of construction area lighting. If construction activities take place at night, down lighting should be implemented to minimise light pollution.				
11) Drilling and blasting of the overburden rock for easy removal by excavators and dump trucks.	Operational Phase for Underground and Opencast Operations	Blasting material during operational phases releases ammonium nitrates from the explosive residues. This chemical contaminates the water in the pit and can	Decrease in water quality. Increase in Noise level. Negative visual impact.	N/A	▪ All the water being pumped from the pit should be stored in the pollution control dams (PCD's) for re-use on the mine so as to prevent unnecessary discharge into the environment; ▪ Based on Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the mine will be diverted away and discharged	control through management and monitoring. Recommended noise control measures (as recommended in previous column). Recommended visual mitigation	Impact avoided/ minimised. Noise levels will be kept to a minimum. There are no national standards for visual.	The expected noise levels from the proposed project will comply with the National Noise Control Regulations	Project Life Operational Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		potentially contaminate the streams if water is discharge into the natural environment. Nitrates and ammonia from blasting residues, can lead to eutrophication (nutrient enrichment) of water bodies. They may also be converted into toxic nitrites. Ammonia (NH3 as opposed to NH4+) is highly toxic to fish and many aquatic organisms at even low (µg/l) concentrations; Mining machinery and vehicles may increase ambient noise levels at surrounding noise sensitive receptors. The removal of overburden by drilling and blasting will have a continual negative visual			to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use. ▪ Only remove overburden when and where necessary; ▪ Overburden stockpiles should be positioned to reduce visual disturbance where possible; ▪ Plant fast-growing endemic vegetation in areas where it can conceal stockpiles; ▪ Ensure vegetation screens are built and maintained; ▪ Limit the height and footprint area of overburden stockpiles where possible; and ▪ Apply dust suppression techniques to limit the dust created by blasting and from the stockpiles.	measures (see previous column).			

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		impact on the receiving environment. This visual impact will be permanent and irreversible. Overburden stockpiling will have a negative visual impact on the receiving environment. Dust from the blasting and from stockpiles will also have a negative visual impact. These visual impacts will occur for the life of the project.							
12) Dumping of waste rock and maintenance of waste rock dump		Mining machinery and vehicles may increase ambient noise levels at surrounding noise sensitive receptors Unconfined stormwater runoff from other contaminated surfaces in the mine have the potential to contaminate the	Decrease in water quality. Increase Noise level. Negative visual impact.	100-200ha	• Based on Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the mine will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. • Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g.	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Project Life Continuation (included in previously approved EMPr)

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		natural water resources. Operation and maintenance of the waste rock dump will have a negative visual impact on the receiving environment. Dust from the dump will also have a negative visual impact on the receiving environment. These visual impacts will occur for the life of the project.			installed exhaust mufflers; and • Switching off equipment when not in use. • Overburden should only be removed when and where necessary; • Stockpiles should be positioned to reduce visual disturbance where possible; • Limit the height and footprint area of stockpiles where possible; • Apply dust suppression techniques to limit the dust from stockpiles; • Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; • Ensure vegetation screens are built and maintained; and • Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.				
13) Removal and loading of ore onto trucks (O/C) or conveyor (U/G) to the plant.		During this stage, waste rock brought to the surface and those from the open cast process is loaded onto 30 tonne tipper trucks and offloaded at the waste rock dumps. The loading and	Increase in Dust. Decrease in water Quality. Increase in Noise level. Decrease in groundwater quantity and quality. Negative visual impact.	>1ha	• To mitigate the impacts of the loading and dumping process, the drop height when loading and offloading must be lowered. • All the water being pumped from the pit or underground should be stored in the pollution control dams (PCD's) for re-use on the mine so as to prevent unnecessary discharge into the environment • Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Project Life (included in previously approved EMPr)

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		offloading process results in dust generated comprises TSP, PM10 and PM2.5 (this fraction is causing health problem in the human respiratory system due to the depth of penetration and the resultant interaction with human tissues). Potential dewatering from underground and opencast mining. The removal of ore will have a continual negative visual impact on the receiving environment. This visual impact will be permanent and irreversible. Infrastructure and mine area lighting will be visible at night resulting in a negative visual			mechanisms are effective e.g. installed exhaust mufflers; and • Switching off equipment when not in use • Dewater aquifer prior to further excavations Dewater very closely to the active mining face; • Manage groundwater abstraction rates and volumes in accordance with borehole sustainable yields; • Monitor groundwater abstractions to ensure that the aquifer from which water is abstracted is not over-exploited; • Pump excess underground water to appropriate surface storage facility according to manage and minimise the water quality impacts. When required by the process plant, the abstracted water can be discharged into the return water dam; • Reuse water as far as possible. An off-take can be installed from the reservoir to the vehicle maintenance bay for use in dust suppression activities and general usage at the bay. However, for dust suppression it is good practice to first use marginal mine water or grey water before using pristine groundwater; and • Monitor water influx, water stored, water removed; and water levels in the underground mine and groundwater levels in the perimeter of the underground mine. • Divert surface flows away from the open pit areas through channels, drains and culverts.				

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		impact on the receiving environment. This visual impact will occur for the life of the project.			• ROM stockpiles should be positioned to reduce visual disturbance where possible; • Limit the quantity and time of ROM stored on site; and • Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.				
14) Continuing operation of existing processing plant (Crusher, settler, gravity plant and reclamation plant).		Impacts on surface water quality as a result of mobilized hazardous substances from trucks and machinery during operation of mine During this stage, the ore from the underground operations and the open pit will be crushed to reduce the size. The dust generated encompasses TSP, PM_{10} and $PM_{2.5}$ (this fraction is causing health problem in the human	Impact on water quality. Increase in dust. Increase in noise levels.	Project area	• To mitigate the impacts, the crusher should be enclosed to control the dust that is generated in the process. The application of water sprays also helps to suppress generated dust thus reducing the impact offsite. • Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Switching off equipment when not in use	Control through management and monitoring,	Impact avoided/minimised		Project Life (included in previously approved EMPr)

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		respiratory system due to the depth of penetration and the resultant interaction with human tissues).							
15) Storage of fuel in diesel tanks, as well as lubricant and explosives in facilities for the duration of the Project.		Impacts on surface water quality as a result of mobilized hazardous substances from trucks and machinery during operation of mine Hydrocarbon spills can impact soil quantity	Hydrocarbon spill Increase risk of soil contamination Impact on water quality	>1ha	▪ Prevent any spills from occurring; ▪ If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities; ▪ All vehicles are to be serviced in a correctly bunded areas or at an off-site location; and ▪ Leaking vehicles will have drip trays place under them where the leak is occurring. ▪ The storage facilities of fuel, lubricant and explosives must be a hard standing area (paved or concrete surface), roofed and bunded. This will prevent mobilization of leaked hazardous substances. Emergency spillage response plan should in place and accessible to the responsible monitoring team				Project Life (included in previously approved EMPr))
16) Vehicular activity on the proposed roads and maintenance activities		This focuses on the use haul roads and then the conveyance of chrome using conveyor belts. Loading and offloading will result in dust emissions. The chrome is loaded	Decrease in air quality/ increase in dust generation Increase in noise levels Decrease in vegetation health due to	25-50ha	▪ To mitigate the impacts, reduce vehicle speed will reduce emission to the atmospheric environment. ▪ Water sprays on the road should be used frequently, keeping the road moist. ▪ Dust suppressants such as Dust-a-side can be applied on the well-defined truck routes. ▪ Making speed humps and ensuring that the speed limits are adhered to or	Recommended visual mitigation measures (see previous column).	There are no national standards for visual.	N/A	Project Life (included in previously approved EMPr)

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		onto trucks and some onto conveyors. During this stage, materials are transported to the various stockpile using 3 tonne tipper trucks, which leads to the generation of fugitive dust comprising TSP, PM_{10} and $PM_{2.5}$. Health & growth of vegetation. Vehicular activity on the haul roads and access or service road will have a negative visual impact on the receiving environment. Dust from vehicular activity will also have a negative visual impact. These visual impacts will occur for the life of the project.	dust. Negative visual impact.		enforced to reduce potential generation of dust particles. ▪ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use ▪ Keeping the road moist. ▪ Dust suppressants such as Dust-a-side can be applied on the well-defined truck ▪ Prevent excess dust creation that could inhibit plant growth by wetting of the haul roads to suppress dust creation as well as cover haul trucks to prevent dust emissions during transport. ▪ To avoid animal deaths specific speed limits must be adhered to by all mining vehicles. ▪ Do not create numerous haul roads alongside each other; ▪ Roads should be wetted frequently by means of a water bowser to suppress dust; and ▪ Vehicles must be roadworthy and obey the recommended speed limits at all times.				
17) The operation of the TSF (dirty water from stormwater and dewatering		Impacts on surface water quality due to unconfined stormwater runoff	Decrease in water quality (surface water and groundwater)	50-100ha	▪ No mining or any operation should take place within a horizontal distance of 100 metres from any watercourse. ▪ Based on Reg 704 requirements regarding storm water management for	Control through management and monitoring,	Impact avoided/minimised		Project Life (included in previously approved EMPr)

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
mining activities) and the connected return water dam		from other contaminated surfaces in the mine have the potential to contaminate the natural water resources. Separation of clean water runoff upstream of the mine area. Water upstream of the mine area is considered clean and will have to be separated from the dirty water area. Dirty water Spillages from the mine area into the environment must be managed Groundwater contamination	Due to contamination		mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the mine will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ Should the contained water be more than the water use requirement, the BPGs advices that the water be recycled or as the last resort be treated to acceptable levels and discharged either to the natural environment or be supplied to other industries as a lower grade of water ▪ The mine water management measures recommended during construction phase should continue during the operational phase; ▪ It is recommended that abstraction from boreholes that are close to the mine workings should be avoided so that contaminants will not migrate away from the mine, towards the abstraction boreholes; ▪ Monthly or quarterly monitoring of groundwater qualities and water levels are recommended (particularly down gradient of the mine site) with continuous refining and updating of the monitoring network based on the results obtained; ▪ Annual audits of monitoring and management systems should be conducted by independent environmental consultants; and				

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
					▪ With the application of the above-stated mitigation plans, the impact of the contaminant migration during construction phase can be lowered to negligible.				
18) Continuing operation and maintenance of the stockpiles, including topsoil and ROM stockpiles.		Impacts on surface water quality due to unconfined stormwater runoff from other contaminated surfaces in the mine have the potential to contaminate the natural water resources. Topsoil losses can occur during the operational phases as a result of rain water runoff and wind erosion, especially from roads and soil stockpiles where steep slopes are present. Materials i.e. ROM, lumpy ore, crusher fines, HMS fines and stockpiles CO1, CO4 and CO6 are stored at their	Loss of stockpiled topsoil Increase in dust Decrease in water quality. Negative visual impact.	100-200ha	▪ Stockpiles are to be maintained in a fertile, vegetated, and erosion free state; ▪ Stockpiles are to be clearly demarcated; ▪ Ensure proper storm water management designs are in place; ▪ Access routes are to be kept to a minimum as to reduce any unnecessary compaction from occurring; ▪ If erosion occurs, corrective actions must be taken to minimize any further erosion from taking place; and ▪ Unauthorised borrowing of stockpiled soil materials should be prevented. ▪ To mitigate the impacts of the stockpiling, water sprays on the stockpiles need to be utilised, use of wind breaks can be implemented near the respective stockpiles as these reduce anticipated dust impacts by 30%.No mining or any operation should take place within a horizontal distance of 100 metres from any watercourse. ▪ Based on Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Project Life (included in previously approved EMPr)

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		respective stockpiles. The various stockpiles thus represent sources of dust, with the subsequent erosion of dust that comprises TSP, PM_{10} and $PM_{2.5}$. Operation and maintenance of the topsoil and ROM stockpiles will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact on the receiving environment. These visual impacts will occur for the life of the project.			emanating from upstream of the mine will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ Should the contained water be more than the water use requirement, the BPGs advices that the water be recycled or as the last resort be treated to acceptable levels and discharged either to the natural environment or be supplied to other industries as a lower grade of water. ▪ Topsoil should only be removed when and where necessary; ▪ Limit the height of soil stockpiles to 3 metres to prevent the soil from becoming compacted and to reduce the visual impact; ▪ Topsoil stockpiles should be vegetated so as to blend into the surrounding landscape; ▪ Stockpiles should be positioned to reduce visual disturbance where possible; ▪ Limit the height and footprint area of stockpiles where possible; ▪ Apply dust suppression techniques to limit the dust from stockpiles; ▪ Plant fast-growing endemic vegetation in areas where it can conceal the stockpiles; ▪ Ensure vegetation screens are built and maintained;				

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
					▪ Limit the quantity and time of ROM stored on site; and ▪ Avoid operational and mining activities at night if possible, thereby avoiding the use of infrastructure and mine area lighting. If operational and mining activities take place at night, down lighting should be implemented to minimise light pollution.				
19) Waste and sewage generation and disposal.		Impacts on surface water quality due to disposal of waste into the streams. Waste storage on site will have a negative visual impact on the receiving environment. This visual impact will occur	Negative visual impact.	10-50ha	▪ Based on Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the mine will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ Should the contained water be more	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Project Life (included in previously approved EMPr) Operational Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		until the waste is removed from the site.			than the water use requirement, the BPGs advices that the water be recycled or as the last resort be treated to acceptable levels and discharged either to the natural environment or be supplied to other industries as a lower grade of water. ▪ Limit the footprint area of the waste storage area where possible; and ▪ Limit the quantity and time of waste stored on site.				
20) Maintenance of secondary infrastructure (offices, parking)				1-2ha					
21) Concurrent replacement of overburden and topsoil and the re-vegetation of mined out strips. The mined strip will be backfilled with the overburden and compacted. Subsequently, the topsoil will be placed on top of the overburden and the area will be vegetated.		Impact on the rehabilitation of soil, soil quality and land capability. Backfilling of soil layers will impact on the land capability by restoring the land capability to some extent because vegetation will be supported and therefore returned to the planned post mining land capability such as arable and or	Loss of land use and capability Potential restoration in indigenous vegetation. Reduced negative visual impact.	Project area	• Mitigation is possible because the land use is changed from mining back to agriculture as follows: • The spoil should be shaped taking the pre-mining landscape into consideration; • The designed post mining landforms should be modelled to establish the post mining landscape stability by using a combination of GIS and erosion modelling techniques by a suitably qualified expert using site specific soil quality data; • The soil layers should be put back in the reverse order of stripping namely subsoil first then topsoil; • The yellow and red soils should be replaced in upland landscape positions; • Wetland soils should be put back in the reverse order of stripping;	Recommended visual mitigation measures (see previous column).	There are no national standards for visual.		Project Life (included in previously approved EMPr)

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		grazing. Impact on indigenous vegetation. Concurrent rehabilitation by replacement of overburden and topsoil as well as re-vegetation as mining progresses will have a neutral visual impact on the receiving environment. The aim of rehabilitation is to return the project area to a state similar to the pre-mining state. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment. Backfilling of the open pit with overburden will use rock removed from the void of the current mining strip to partly fill			• Wetland soils should be placed in lower landscape positions; • The soil quality should be investigated prior to establishing vegetation on the rehabilitated soil through representative sampling and laboratory analysis; • The analytical data should be evaluated by a suitably qualified expert and vegetation fertility and or soil acidity problems should be corrected prior to vegetation establishment; • Clear targets incorporating medium to long term post mining land capability influencing land use, should be part of a potentially successful closure plan; and • From a national food security viewpoint, ways need to be found of rendering land rehabilitated to arable standards suitable for the economic production of cash crops. Reduce areas available for alien infestation by restoring disturbed areas to natural habitat. • Implementation of an alien invasive management program is imperative to reduce the risk of these plant species infesting the mine area. • Backfill as much of the open pit area as possible; • Spread topsoil over the backfilled area; and • Re-vegetate the backfilled area.				

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		the mined out void in the previously mined strip. Once backfilling commences, overburden should no longer be added to the overburden stockpiles. This will have a neutral visual impact on the receiving environment. Spreading of topsoil and re-vegetation of the backfilled areas will have neutral visual impacts on the receiving environment.							
22) Removal of surface infrastructure (Plant machinery, shafts, conveyors)	Decommissioning of Opencast and Underground operations	Mobilization of leaked/spilled contaminants (hazardous and hydrocarbon containing material) from trucks and machinery during decommissioning phase could have an impact on the quality of water in	Decrease in water quality Increase in Noise levels. Reduced negative visual impact.		• Use of accredited contractors for removal or demolition of infrastructures should be ensured • Water quality monitoring should continue to enable the detection of decant when it occurs so immediate mitigation measures can be implementedRestricting construction activities to daylight hours where viable; • Mining related machines and vehicles to be serviced on a regular basis to	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Project Life Decommissioning Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		the nearby streams. Demolition and removal of infrastructure will have a neutral visual impact on the receiving environment. This will help to reverse some of the changes that occurred when the infrastructure was constructed.			ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Switching off equipment when not in use. • Ensure that all unnecessary infrastructure is demolished and removed from the site.				
23) Decommissioning of services (if necessary, depending on post landuse) incl. waste treatment and removal, power & water facilities)		Mobilization of leaked/spilled contaminants (hazardous and hydrocarbon containing material) from trucks and machinery during decommissioning phase could have an impact on the quality of water in the nearby streams as well as the vegetation	Decrease in water quality Impact on vegetation health and cover.		• Use of accredited contractors for removal or demolition of infrastructures should be ensured • Water quality monitoring should continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented • Avoid spillage of hazardous materials, thereby protecting vegetation and soil. The correct and careful handling of the infrastructure housing pollutants and toxicants to prevent spillages and leaks. • Avoid destruction of vegetation, the creation of favourable habitat for fast growing invasive plants and ground compaction, by forcing vehicles to make use of existing roads and designated areas. Avoid rehabilitated and natural habitat areas as far as possible.	Control through management and monitoring,	Impact avoided/minimised		

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
					• The implemented alien invasive control program must be adhered to carefully.				
24) Rehabilitation of roads and cleared areas (offices and workshop area)		Construction vehicles will result in an increase in ambient noise. Rehabilitation of the roads and cleared areas by replacement of topsoil will have a neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-mining state. Spreading of topsoil, and profiling and contouring to create a free-draining topography will have a neutral visual impact. Re-vegetation of the rehabilitated areas will have a neutral visual impact.	Increase in noise level. Reduced negative visual impact.		• Restricting construction activities to daylight hours where viable; • Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Switching off equipment when not in use. • Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; • Spread topsoil over the rehabilitated area; • Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; and • Re-vegetate the rehabilitated areas.	Recommended visual mitigation measures (see previous column).	There are no national standards for visual.		Project Life Decommissioning Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		These visual impacts will be permanent. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment.							
25) Removal of fuel, lubricant and explosives		Mobilization of leaked/spilled contaminants (hazardous and hydrocarbon containing material) from trucks and machinery during decommissioning phase could have an impact on the quality of water in the nearby streams	Decrease in water quality	N/A	• Use of accredited contractors for removal or demolition of infrastructures should be ensured • Water quality monitoring should continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented	Control through management and monitoring,	Impact avoided/minimised		
26) Safe closure of shafts and mine access ramps		This will have a positive impact on the drainage pattern of the area, increased runoff will be reporting to the natural water resources.	Positive impact on Quantity		▪ Use of accredited contractors for removal or demolition of infrastructures should be ensured ▪ Water quality monitoring should continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented	Control through management and monitoring,	Impact avoided/minimised		
27) Final replacement of overburden and		This will have a positive impact on the drainage	Positive impact on Quantity		▪ As the opencast mining progresses, continuous rehabilitation should be implemented by backfilling the voids	Recommended visual mitigation measures (see	There are no national standards for visual.		Project Life Decommissionin

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
topsoil and the establishment of vegetation on the final open cast void. Overburden will be backfilled into the final void and compacted. Subsequently, topsoil will placed and the area vegetated.		pattern of the area, increased runoff will be reporting to the natural water resources. Rehabilitation of the final open void (where possible) by replacement of overburden and topsoil will have a neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-mining state. Once ore has been removed from the open pit, there will be insufficient overburden to fill the void completely. Due to this material imbalance, a permanent void will remain. Spreading of topsoil, and profiling and	Potential to restore water quality Increase in noise levels Potential to restore indigenous vegetation. Reduced negative visual impact.		▪ The backfilled areas should be vegetated as soon as possible to prevent dust and siltation of the water bodies ▪ Where rehabilitation (grass seeding of topsoil cover) is not effective, sedimentation should be mitigated by installing silt traps at areas where the surface runoff enters the surface water resources ▪ Restricting construction activities to daylight hours where viable; ▪ Mining related machines and vehicles to be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use. ▪ The footprint of the area disturbed by the mining operation will have topsoil and overburden replaced to restore the vegetation cover, through proper rehabilitation. ▪ Limit the erosion potential of exposed areas by re-vegetation. ▪ Re-vegetated areas will form seepage areas which will help aid infiltration. ▪ Backfill as much of the final void as possible; ▪ Ensure that the final void is as small as practically possible; ▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated	previous column).			g Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		contouring to create a free-draining topography will have a neutral visual impact. Re-vegetation of the rehabilitated areas will have a neutral visual impact. These visual impacts will be permanent. Rehabilitation will assist to reduce the negative visual impact of mining on the receiving environment.			area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; and ▪ Re-vegetate the rehabilitated areas.				
28) Waste handling of scrap metal and used oil as a result of the Decommissioning Phase will be undertaken.		Mobilization of leaked/spilled contaminants (hazardous and hydrocarbon containing material) from trucks and machinery during decommissioning phase could have an impact on the quality of water in the nearby streams. Waste storage on	Decrease in water quality. Negative visual impact.	N/A	• Use of accredited contractors for removal or demolition of infrastructures should be ensured • Water quality monitoring should continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented. • Limit the footprint area of the waste storage area where possible; and • Limit the quantity and time of waste stored on site.	Control through management and monitoring. Recommended visual mitigation measures (see previous column).	Impact avoided/minimised. There are no national standards for visual.		Project Life Decommissioning Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
		site will have a negative visual impact on the receiving environment. This visual impact will occur until the waste is removed from the site.							
29) Post-closure monitoring and rehabilitation will determine the level of success of the rehabilitation, as well as to identify any additional measures that have to be undertaken to ensure that the mining area is restored to an adequate state. Monitoring will include surface water, groundwater, soil fertility and erosion, natural vegetation and alien invasive species and dust generation from the discard	Post-closure	Decant of poor quality groundwater from the mining areas may have a negative impact on the surrounding surface water resources. Post-closure monitoring and rehabilitation is essential to limit the impact of the proposed Lanxess Chrome Mine Expansion Project on the receiving environment. This is a neutral impact that will help to reverse some of the negative impacts.	Contamination of water Decant of poor quality water. Reduced negative visual impact.		• Surface water quality monitoring should continue to ensure that there is no impact on the surrounding water resources emanating from the mine area. • Direct rehabilitation efforts by ensuring correct measures are employed for a variety of rehabilitation projects • Avoid erosion, alien invasive species establishment, by monitoring rehab outcome to ensure open areas are eliminated. • Monitor water level rise and apply stage curves to assess the rate of flooding; • Seal mine shafts to prevent surface water from flowing into the defunct underground voids; • Seal all boreholes that connects the mine void to surface; • Monitor pit water level rise and apply stage curves to assess the rate of flooding • Monitor groundwater levels in	Recommended visual mitigation measures (see previous column).	There are no national standards for visual.		Project Life Post- Closure Phase

Activities	Phase	Aspect Affected	Potential impacts	Size and scale of disturbance of the activity	Mitigation Measures	Mitigation type	Standard to be achieved	Compliance with standards	Time period for implementation
dumps.					boreholes in the surrounding aquifers to assess groundwater table responses; and • Groundwater monitoring should continue up to 5 years after closure • No abstraction boreholes should be drilled in a 3 km radius from the underground workings in the post closure environment; • No abstraction boreholes should be drilled in 2.5 km radius from the pit in the post closure environment • Perform effective rehabilitation and closure of redundant facilities through material placing and shaping, capping with appropriate capping liners and re-vegetation to prevent post closure infiltration through sources; and • Consider groundwater plume remediation only if post closure monitoring indicates a persistent pollution plume at unacceptable concentrations. • Ensure that all disturbed areas are rehabilitated to a state as close as possible to the pre-mining state; and • Carefully monitor the rehabilitated areas to ensure that rehabilitation is successful.				

7 Financial Provision

7.1 Item (i)(1): Determination of the Amount of Financial Provision

7.1.1 Item (i)(1)(a): Describe the Closure Objectives and the Extent to which they have been Aligned to the Baseline Environment Described under Regulation 22 (2) (d) as Described in 2.4 herein

The rehabilitation of Lanxess Chrome Mine will require significant levels of control and monitoring during implementation if the desired objectives are to be achieved. In brief, these objectives are:

- Produce a free draining, and stable topography (landscape);
- Ensure erosion free, sustainable vegetation;
- Return rehabilitated land-use to the pre-mining environment where possible;
- Minimise negative impacts and maximise positive benefits on the local community;
- Follow a comprehensive consultation and communication process with all stakeholders.
- Prevent soil and surface/groundwater contamination by managing all water on site to acceptable and agreed standards; and
- Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure.

The Lanxess Chrome Mining operation aims to employ concurrent rehabilitation methods (direct replacement) of overburden materials from the current mining strip to the completed mining strips (open voids) with the ultimate goal to return the project area as far as possible back to the most sustainable landscape either the original landscape/topography or to a novel topography that is free draining and matches the surrounding topography.

Based on preliminary calculations done thus far it is assumed that there should be enough material to backfill the open pit that will be left once mining has ceased. In addition to this there should be enough material to rehabilitate and profile the area back to the pre-mining topography or close enough to the pre-mining topography as possible. In the event that the area cannot be rehabilitated back to the pre-mining topography, then the area must be rehabilitated to a state that matches the surrounding topography. Special attention must be given when placing material back into the pit and profiling to ensure that the landscape is free draining and that no ponding of water occurs. It is always important to ensure that there is a reserve of topsoil material for the touch up applications, to fill small depressions that may occur as a result of subsistence.

7.1.2 Item (i)(1)(b): Confirm Specifically that the Environmental Objectives in relation to Closure have been Consulted with Landowners and Interested and Affected Parties

All the closure objectives based on the post mining land use will be consulted with I&APs during the PPP as part of the application. All the I&APs will be included in the stakeholder database and will always be notified of any documentation related to the project and where these can be accessed.

7.1.3 Item (i)(1)(c): Provide a Rehabilitation Plan that Describes and shows the Scale and Aerial Extent of the Main Mining Activities, including the Anticipated Mining Area at the Time of Closure

The approximate size of the mining lease area is 1 169 Ha and based on the mine layout plan approximately 130.79 ha of the total surface area is expected to be disturbed by the proposed mining activities. The pre-mining environment will be mapped against the post-mining environment to determine the appropriate portions of land that will need to be rehabilitated at closure. A site specific rehabilitation plan has been compiled and it is attached in Appendix G.

7.1.4 Item (i)(1)(d): Explain why it can be Confirmed that the Rehabilitation Plan is Compatible with the Closure Objectives

The closure objectives are regarded as guidelines for what the rehabilitation plan should entail. The rehabilitation plan will details how rehabilitation will need to be undertaken and will include management of soil resources and placement of soil once mining is completed. In addition to this the rehabilitation plan also contains information associated with re-shaping of the landforms (topography plan), operational and post-closure water management, replacement of soils, re-vegetation of the landscape; and monitoring and maintenance. The successful rehabilitation of the site will ensure the rehabilitated area is free draining, erosion free and produce sustainable vegetation as per the closure objectives stated above.

7.1.5 Item (i)(1)(e): Calculate and State the Quantum of the Financial Provision Required to Manage and Rehabilitate the Environment in Accordance with the Applicable Guideline

The financial provision was calculated by means of the DMR's standard method for assessment of mine closure. The closure liability only focused on the proposed mining activities and the cost for rehabilitation and closure of the proposed site according to the DMR Guideline format is R 39 496 122.47. Please refer to Appendix G for the closure report detailing how the calculations were made.

7.1.6 Item (i)(1)(f): Confirm that the Financial Provision will be Provided as Determined

Lanxess Chrome Mining operation will update its financial provision annually and will contribute to a trust fund or other form of financial guarantee for rehabilitation provision, as required in terms of Section 24P of NEMA, as amended. Contributions to the fund will be made in accordance with the requirements of tax legislation and policy and this will be made up in a manner acceptable to the DMR.

8 Monitoring Compliance with and Performance Assessment

A legal compliance and Environmental Management System (EMS) audit will be regularly conducted by professional consultants throughout the life of the mine, to monitor the EIA and EMP process and the rehabilitation process and to advise on any mitigation measures which need to be added to the existing programmes.

A report will be submitted to mine management annually covering all aspects investigated during the audit, and providing suggestions and recommendations as to how the rehabilitation programme is progressing, and any improvements which could be made.

The Audit will be conducted according to the following acts and regulations;

- National Water Act,1998 (Act No. 36 of 1998) (NWA);
- MPRDA;
- NEMA; and
- Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA).

The audit will take into consideration the management principles and strategies stated in the Environmental Management Programme, and assess whether this strategy is providing the required results. Any flaws found in the rehabilitation process will be included in the report along with the recommended mitigation measures.

A report will be compiled in accordance with the above listed government acts, on a biannual basis to mine management, who may then decide the appropriate actions to be taken, along with an updated financial provision.

8.1 Item 1(g): Monitoring of Impact Management Actions

8.1.1 Dust Monitoring Programme

It recommended that the management of Lanxess continue the current dust monitoring programme throughout the project life of the mine. This will ensure that historical dust deposition data is available to feed into management practices aimed at reducing impacts from the construction, operation and closure phases of the project.

As the area exposed is directly proportional to the amount of dust generated and transported, it is advised that construction activities be limited during the windy periods of August, September and October. If construction has to be done during this period, it is advised to disturb a small area at a time. As trucks are a major source of dust, reducing speed of trucks in haul roads will reduce dust immensely.

In order to determine the wind speed for each particular day, a wind anemometer installed on site should be utilised. Wind speeds are recorded daily and when it exceeds 5.4 m/s (this is the threshold for transporting particles) extra dust control measures need to be carried out. During dust generating periods, sprinkling until it is moist is ideal for haul roads and traffic routes. It must be noted however that excessive sprinkling to manage dust may result in runoff from the site.

8.1.1.1 Particulate Monitoring Programme

Lanxess should establish a fine particulate monitoring programme which should include at least one particulate instrument to monitor either PM_{10} or $PM_{2.5}$. Ideally, both set of pollutants should be monitored as required by regulatory authorities. In addition to pollutants, the ambient monitoring unit should include measurement of meteorological parameters representative of the mining area. Air dispersion modelling should always use site specific data if available. It is advised to install the unit at least one year prior to the construction phase to allow for the collection of ambient air quality baseline data set.

8.1.2 Ecological Monitoring Programme

A monitoring programme, which assesses the ecological state of the terrestrial ecological resources, is recommended. On site monitoring must take place to identify negative trends in the ecosystem, adaptive management will then be applied to correct these negative trends; bush encroachment and alien invasive plant species should be considered.

8.1.2.1 Flora

When removing alien invasive species and weeds, care must be taken to eradicate the plants fully. According to the Alien and Invasive Species Lists, 2014 (GN R599 in *GG* 37886 of 1 August 2014) of the NEMBA. Eradicate means to treat plants by any suitable method in order to prevent such plants from growing, multiplying and propagating. Therefore, when removing plants from the site it should be done at such a time when they are not producing seeds that could easily be spread by wind during cutting and transport. Plants that are known to grow back easily need to be uprooted in order to remove all possible avenues for re-growth and any juvenile plants spotted growing during the operation need to be removed before they become a problem.

8.1.2.2 Fauna

The animal survey revealed a very poor density and diversity of fauna on and around the Lanxess extension area. For this reason management of fauna during the operation will be

minimal, except on the koppie, bushveld area and rocky bushveld areas. It is likely that small mammals such as mongoose or hares are living on the extension area. Should any such animals be disturbed by the activities, the operators will be required to call in qualified people to handle and relocate the animals in question. It is however likely that they will move at their own free will. The same methodology must be applied to bird life when nests are found.

8.1.3 Surface Water Monitoring Programme

A monitoring programme is an essential management tool to detect negative impacts on water as they arise resulting from the existing mining activities as well as the newly proposed mine extension. This helps to ensure that the necessary mitigation measures are implemented.

A monitoring programme is already in existence. Both surface and groundwater is monitored on a monthly basis from local boreholes in the vicinity of the mining area and on the mine water dams. It is also necessary to monitor the surrounding water quality on the nearby streams in order to ensure no polluted water is reaching the local water resources.

8.1.4 Groundwater Monitoring Programme

Groundwater monitoring has to continue during all phases of the mine operation to identify the impact on the groundwater environment over time, and so that effective measures can be taken at an early stage before serious damage to the environment occurs.

8.1.4.1 Proposed Monitoring Boreholes

The main objectives in positioning the monitoring boreholes are to:

- Monitor the movement of polluted groundwater away from the mine area;
- Monitor the lowering of the water table and the radius of influence; and
- Monitor post closure groundwater recovery and pollution plume migration.

As obtained from the desktop study, a couple of monitoring boreholes exist in the project area. No additional drilling is proposed for the Wonderkop segment. The existing WKG boreholes would be sufficient for groundwater monitoring in the Wonderkop segment. Apart from the existing Lanxess monitoring boreholes and the Wonderkop monitoring boreholes, the existence of all other boreholes listed in the DWS database could not be verified. It is therefore proposed to drill monitoring boreholes for Kroondal, Overstep and Klipfontein segments.

The location of monitoring boreholes for the Kroondal and Klipfontein segments is limited by the presence of overlying tailings dam.

Eight new monitoring boreholes are recommended based on the impact assessment. Each borehole is recommended to be drilled to a maximum depth of 60 m below surface to monitor the water level and quality in the weathered and fractured aquifer in the Kroondal, Klipfontein, and Overstep segments. In total, 44 monitoring points are recommended for the proposed groundwater monitoring as given in Table 8-1. Furthermore, it is recommended

that LCM combines efforts with the surrounding mining operations in order to establish a more comprehensive monitoring program to assess the cumulative impacts on groundwater resources in the area.

Table 8-1: List of proposed monitoring boreholes

BHID	Coordinates (LO 27 WGS84)	
	Y-Coordinate	X-Coordinate
DWE1	35379	-2845928
DWE2	34591	-2845731
DWE3	35312	-2844525
DWE4	37205	-2843965
DWE5	37280	-2844940
DWE6	39571	-2843993
DWE7	38870	-2844006
DWE8	38722	-2843272
LANBH02	39742	-2846565
LANBH03	40281	-2847152
9A	36451	-2846496
13	38321	-2847399
15	35672	-2846745
17	37933	-2847475
18	37826	-2846954
12	38181	-2846357
20	38032	-2846478
19	37409	-2846200
22	38416	-2845183

8.1.4.2 Water Level

Groundwater levels must be recorded on a quarterly basis using an electrical contact tape or pressure transducer, to detect any changes or trends in groundwater flow direction or head.

8.1.4.3 Water Sampling and Preservation

When sampling the following procedures are proposed:

- One (1) litre plastic bottles with a cap are required for the sampling exercises – provided by the water laboratory;
- Glass bottles are required if organic constituents are to be tested; and
- Sample bottles should be marked clearly with the borehole name, date of sampling, sampling depth and the sampler's name and submitted to a SANAS accredited laboratory.

8.1.4.4 Sampling Frequency

Groundwater is a slow-moving medium and drastic changes in the groundwater composition are not normally encountered within days. Monitoring should be conducted on a quarterly basis. Samples should be collected by an independent groundwater consultant, using best practice guidelines and should be analysed by an accredited laboratory.

It is suggested that the quarterly samples be collected, including up to 10 years post closure and based on the results it can be adjusted accordingly. Monitoring should continue until an acceptable water quality situation is reached.

8.1.4.5 Parameters to be Monitored

Analyses of the following constituents are recommended:

- EC, pH, TDS;
- Macro Analysis i.e. Ca, Mg, Na, K, SO_4, NO_3, F, Cl; and
- Heavy metals As, Al, Ba, Co, Cr, Zn, Cd, Cu, Fe, Ni, V, Mn, Se.

8.1.4.6 Data Storage

In any project, good hydrogeological decisions require good information developed from raw data. The production of good, relevant and timely information is the key to achieve qualified long-term and short-term plans. For the minimisation of groundwater contamination it is necessary to utilize all relevant groundwater data.

The generation and collection of this data is very expensive as it requires intensive hydrogeological investigations and therefore has to be managed in a centralised database if funds are to be used in the most efficient way. Digby Wells has compiled a WISH-based database during the course of this investigation and it is highly recommended that Lanxess utilise this database and continuously update and manage as new data becomes available.

8.2 Item 1(h): Monitoring and Reporting Frequency

Monitoring should be conducted on a quarterly basis at least, whilst a consolidated monitoring report should be compiled on an annual basis.

8.3 Item 1(i): Responsible Persons

The Environmental Manager (or person in a similar capacity) must act as the responsible person in charge of undertaking the various monitoring programs.

8.4 Item 1(j): Time period for Implementing Impact Management Actions

Once construction and/or mining activities have commenced. Some of the mitigation measures are temporary and are proposed for different phase in the LOM. These are indicated in the management tables.

8.5 Item 1(k): Mechanism for Monitoring Compliance

An annual performance audit (both internal and external) should be conducted by the Mine and an external consultant, respectively.

Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
Potential increase in Dust generation	It is required to collect and record dust deposition data to create a historical baseline for the site.	It is the role and responsibility of an appointed environmental officer to collect dust samples and to record wind speed/direction	Monthly monitoring
Potential increase of fine particulates	It is recommended that either/or PM_{10} or $PM_{2.5}$ are monitored with an ambient monitoring unit to supplement the baseline data and to track increases based on mining activities on the site	It is the role and responsibility of an appointed environmental officer to download the relevant data and track patterns and trends as well as store historical data.	It is advised to install the unit at least one year prior to the construction phase to allow for the collection of ambient air quality baseline data set
Potential decrease in ecological state	On site monitoring must take place to identify negative trends in the ecosystem, adaptive management will then be applied to correct these negative trends; bush encroachment and alien invasive plant species should be considered	It is the role and responsibility of an appointed environmental officer to monitor the success of alien species eradication. It is recommended that a specialist be bought in annually to assist and assess success of rehab as well as alien species eradication	An on-site assessment can be done monthly to determine the spread of alien invasives or the success of a weed management program
Potential decrease in water quality (surface and groundwater)	The monitoring of water will assist in the early detection of issues on site and enable the site to remediate or mitigate where possible. It is also required to monitor the movement of polluted groundwater migrating away from the mine area. This is done with the use of boreholes and samples taken from surface water points around the infrastructure. Analyses of the following constituents are recommended: ■ Ec, pH, TDS; ■ Macro Analysis i.e. Ca, Mg, Na, K, SO4, NO_3, F, Cl; and ■ Heavy metals As, Al, Ba, Co, Cr, Zn, Cd, Cu, Fe, Ni, V, Mn, Se.	The continuation of Lanxess currently monitoring programme by the officers with some additional sites included (as discussed in Section 8)	Quarterly samples (should be increased to monthly for surface water points if a problem is detected). It is suggested that the quarterly samples be collected, including up to 10 years post closure and based on the results it can be adjusted accordingly. Monitoring should continue until an acceptable water quality situation is reached.
Potential decrease in water quantity	The monitoring of water levels in boreholes will detect the lowering of the water table and confirm the radius if influence.	The continuation of Lanxess currently monitoring prograame with some additional sites included (as discussed in Section 8)	

9 Item 1(l): Indicate the Frequency of the Submission of the Performance Assessment Report

It is recommended that a performance assessment is submitted to the Regional Manager every two years.

10 Item 1(m): Environmental Awareness Plan

10.1 Item 1(m)(1): Manner in which the Applicant Intends to Inform His or Her Employees of any Environmental Risk which may Result from their Work

The purpose of the Environmental Awareness Plan is to outline the methodology that will be used to inform Lanxess staff of environmental risks that may result from the working environment, and the manner in which these risks will be dealt with in order to reduce the potential degradation of the environment.

10.1.1 Communication Strategy

The communication of the environmental risks for each phase of the project will take place at local training centres with personnel from both the administrative and mine worker sectors of the mine.

10.1.2 Management Sector

The communication of the environmental risks to the administrative sector will occur through a one-day workshop. This workshop will seek to explain the following necessary actions:

Firstly each aspect will be described, as well as their significance. Risks associated with each aspect will be discussed to ensure that an understanding of how each action of the project may impact on the environment.

The mitigation of the environmental risk will be elaborated on. It is important that each person understands these management strategies as it ensures that the impact on the environment is kept to a minimum. Data collection regarding each aspect will also be explained to ensure that each aspect is monitored according to those protocols specified by the mine and DME. Along with data collection the reporting of findings will be discussed.

This workshop will take place before the construction phase begins thus ensuring a full understanding of the project and its associated environmental risks before any mining begins. The course will be repeated at the beginning of the operational phase and the material will be integrated in the induction for new personnel.

10.1.3 Mine Workers Sector

The mine workers sector will attend a full day induction coarse to ensure that each person is aware of the environmental risks associated with the project. This induction will form part of the health and safety induction if timing allows.

This induction course will explain and describe the relevant phases of the project as well as those environmental risks that may occur during these phases. The environmental risks of each aspect as well as the mitigation will be elaborated on.

As a method of gaining an understanding of the relevant risks, a play or industrial theatre will be performed to explain lay issues and the employees will be encouraged to rehearse and act out a play of their own. These workshops will be conducted in English as well as one of the local languages and translators will be provided where necessary. The course will take place prior to mining commencing, thus ensuring an understanding of the mine workings and risks.

10.1.4 Evaluation of the Environmental Awareness Plan

The evaluation of the Environmental Awareness Plan will be conducted by either the management or qualified sub-contractors chosen by the mine. This evaluation will entail the auditing of the operation in both the construction and operation phase once activity has commenced.

The EAP described above will make all those involved with the project aware of the risks that may occur as well as the necessary mitigation required to minimise these risks. This awareness plan displays that Lanxess is serious about the environment's wellbeing, empowerment of the local people and returning the land to the appropriate use in the future.

Environmental issues will be highlighted at regular meetings scheduled at the mine.

10.2 Item 1(m)(2): Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

Phase	Aspect	Environmental Risk	Communication Strategy				Mitigation Activity
			Management	Administration	Mine workers	Contractors	
Operational Phase	Soil	Loss of structure and fertility. Contamination of soils. Loss of soil through erosion.	Workshop	Course	Induction & Monthly Meetings	Induction & Monthly Meetings	Stockpiled to height of less than 4 m and vegetated. Hydrocarbon spill kit kept on site and rehabilitation area designated. Areas of erosion reported on a monthly basis and rehabilitated.
	Animals	Habitat loss Fire Hazard Disturbance					Remediation of the soil and re-vegetation will restore animal habitat. Hunting and trapping prohibited on the mine property. Open fires will be prohibited on the property. Report any rare or endangered species.
	Vegetation	Removal of vegetation Invader species					Red Data species reported and protected. Invader species will be eradicated on site. Disturbed areas will be rehabilitated and re-vegetated.
	Surface water	Contaminated runoff from the mining property					All contaminated water to be stored and treated on site before being returned to the catchment.

Phase	Aspect	Environmental Risk	Communication Strategy				Mitigation Activity
			Management	Administration	Mine workers	Contractors	
	Groundwater	Acid mine drainage could cause contamination. Potential to de-water natural springs.	Workshop	Course	Induction & Monthly Meetings	Induction & Monthly Meetings	AMD generation will be communicated to mine management to allow an understanding of the process. Exposure to oxygen of acid generating material will be limited through cladding or flooding. Water ingress into the pits will be prevented to limit AMD. All dirty water will be collected in the dirty water system during the operational phase.
	Air quality	Dust generation by blasting and trucks					Dust will be suppressed by water cart on the haul roads and in the disturbed area of the mine.
Decommissioning Phase	Soil	Lack of soil fertility	Workshop	Course	Induction	Induction	Fertilisation programmes will be introduced.
	Vegetation	Alien Species					Remove alien species & plant only indigenous vegetation.
	Surface water	Acid mine drainage – Decrease quality of the water source/s	Workshop	Course	Induction	Induction	Monitoring of water sources
	Groundwater	Acid mine drainage – Contamination of aquifers					Monitoring of water sources

11 Item 1(n): Specific Information Required by the Competent Authority

No request for other information has been made by any other competent authority as yet. The Applicant has confirmed that the financial provision will be reviewed annually and this is likewise confirmed by the EAP.

12 Item 2: Undertaking

The EAP herewith confirms:-

2(a) the correctness of the information provided in the reports

2(b) the inclusion of comments and inputs from stakeholders and I&APs ;

2(c) the inclusion of inputs and recommendations from the specialist reports where relevant; and

2(d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

The EAP hereby confirms the above.

Appendix A: Qualifications of EAP

Appendix B: Directly Affected and Adjacent Landowners

Appendix C: Announcement Material

Appendix D: Correspondence with I&APs

Appendix E: Public Participation and Comments and Response Report

Appendix F: Maps

Appendix G: Specialist Studies

- Air Quality Impact Assessment
- Fauna and Flora Report
- Surface Water Assessment
- Geohydrological Assessment
- Soils, Land Capability and Land Use Assessment
- Visual Impact Study
- Noise Impact Report
- Heritage Report
- Rehabilitation Plan
- Closure Liability Report

Appendix 3: Regional Setting map/Local Setting map and Proposed Open pit Infrastructure map

Appendix 4: Site Plan