Lanxess Chrome Mine
Section 102 Amendment

Visual Impact Assessment Report

Project Number:

LAN3111

Prepared for:

Lanxess Mining (Pty) Ltd

June 2015

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Project Name:	**Lanxess Chrome Mine** **Section 102 Amendment**
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Name	**Responsibility**	**Signature**	**Date**
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EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) has been appointed by Lanxess Mining (Pty) Ltd (Lanxess) as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) according to the NEMA, including the associated specialist studies for the proposed Lanxess Chrome Mine Expansion Project, and the required Public Participation Process (PPP). The environmental considerations for the impact assessment phase of the EIA included a VIA for the proposed Lanxess Chrome Mine Expansion Project.

The proposed Lanxess Chrome Mine Expansion Project is an extension of the existing Lanxess Chrome Mine situated on the western limb of the Bushveld Igneous Complex. This region is characterised by settlements and agriculture interspersed with mining activities. The project area falls within the Rustenburg Local Municipality and the Bojanala District Municipality of the North West Province, South Africa. The nearest settlement is Photsaneng situated approximately 2 km north of the project area. The nearest major town is Rustenburg situated approximately 11.9 km west-north-west of the project area.

The topography of the opencast project area is relatively flat with the exception of the rocky hill in the north-western corner and the small rocky outcrops on the eastern side of the project area. The opencast project area is situated on a spur above several river valleys. The surrounding area has an undulating topography with numerous ridges and river valleys. The Magaliesburg mountain range is approximately 3 km south of the opencast project area.

The topographical model indicates that the elevation of the opencast project area increases from 1218 metres above mean sea level (m.a.m.s.l.) on the eastern side to 1279 m.a.m.s.l. on the rocky hill in the north-western corner. The majority of the opencast project area has gentle slopes of less than 2.2°. Isolated steeper slopes of between 2.2° and 12.6° occur on the rocky outcrops along the eastern side of the project area. The steepest slopes occur on the rocky hill in the north-western corner of the project area and range from 12.6° to 31.4°.

Due to the undulating topography, the slope aspect / direction of the opencast project area is not in any specific direction. The undulating topography is expected to provide moderate screening of the proposed development. The receiving environment is characterised by agriculture and mining with little of the natural vegetation (Marikana Thornveld, Moot Plains Bushveld and Norite Koppie Bushveld) remaining. The proposed project is expected to partially blend in with the surrounding mining activity. The agricultural and natural Bushveld and Thornveld vegetation will only provide minimal screening of the proposed development.

A viewshed is a geographical area, defined by the topography, within which a particular feature will be visible (Oberholzer, 2005). The theoretical viewshed model for the proposed Lanxess Chrome Mine Expansion Project was refined to a practical viewshed model with a buffer of 6 km around the proposed infrastructure and divided into areas that are likely to experience different categories of visual exposure. Due to the nature of the receiving environment it is unlikely that the proposed infrastructure will be noticeable beyond this 6 km

buffer. The practical viewshed model depicts the area from which the proposed Lanxess Chrome Mine Expansion Project is likely to be visible. This practical viewshed covers an area of 59.75 km^2.

The proposed Lanxess Chrome Mine Expansion Project has 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 Lanxess Chrome Mine Expansion 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 a significant impact on the receiving environment. The receiving environment and receptors of the proposed Expansion Project have a moderate sensitivity. The receiving environment has a moderate VAC because there is partial screening by the topography. The proposed Expansion Project will therefore have a moderate visual impact on the receiving environment.

The proposed Lanxess Chrome Mine Expansion Project will have negative visual impacts on the receiving environment, but these impacts can be reduced by implementing various mitigation measures. The most important of these is rehabilitation with the emphasis being on re-contouring the site and reconstructing the surface water and drainage lines. The success of this rehabilitation will influence the overall long term impact of the proposed project on the topography and visual / aesthetic character of the receiving environment.

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Abbreviations and Acronyms

CD: NGI	Chief Directorate: National Geospatial Information
CV	Curriculum Vitae
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ELC	European Landscape Convention
GHG	Greenhouse Gas
Glencore	Glencore Operations South Africa (Pty) Ltd
ha	hectares
HMS	Heavy Medium Separation
IFC	International Finance Corporation
kt	Kilo tons
Lanxess	Lanxess Mining (Pty) Ltd
LHD	Load Haul Dump
LOM	Life of Mine
m.a.m.s.l.	Metres above mean sea level
m.b.s.	Metres below surface
m	Metres
mm	Millimetres
MPRDA	Mineral and Petroleum Resources Development Act No. 28 of 2002
NEMA	National Environmental Management Act No. 107 of 1998
NEM: PAA	National Environmental Management: Protected Areas Act No. 57 of 2003
NHRA	National Heritage Resources Act No. 25 of 1999
O/C	Opencast

PGMs	Platinum Group Metals
PPP	Public Participation Process
ROM	Run of Mine
tpm	Tons per month
TSF	Tailings Storage Facility
U/G	Underground
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment

1 Introduction

"Visual, scenic and cultural components of the environment can be seen as a resource, much like any other resource, which has a value to individuals, to society and to the economy of the region" (Oberholzer, 2005). A Visual Impact Assessment (VIA) is a specialist study performed to identify the visual impacts of the proposed project on the receiving environment.

This report describes the current topography and visual / aesthetic character of the receiving environment and the expected visual impacts of the proposed Lanxess Chrome Mine Expansion Project. The impacts are described and rated, and mitigation measures to reduce the negative impacts and enhance the benefits of the proposed project are also discussed in this VIA.

A study was conducted to identify and evaluate the surface features using ArcGIS 3D Analyst Extension to create a topographical model, and the resultant slope intensity, slope aspect and viewshed models.

2 Project Description

2.1 Background

Lanxess Chrome Mine 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 Mining (Pty) Ltd (Lanxess) has proposed an expansion of their existing underground chrome operations into neighbouring portions as well as the establishment of an open pit operation within their existing mining rights area.

The proposed project is obligated to comply with the requirements of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and the Environmental Impact Assessment Regulations, 2014, promulgated in terms of Sections 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) (GN R982 of 4 December 2014). Lanxess currently has an Environmental Impact Assessment and Environmental Management Plan (EIA/EMP) in line with the MPRDA and would, therefore, need to amend the existing approved document to include the details of the proposed opencast mining operations as well as the extension of the underground sections as part of a Section 102 amendment.

An amendment to the existing Integrated Water Use License Application (IWULA) submitted to the Department of Water Affairs (DWA) will also be required.

2.2 Location

Lanxess Chrome Mine is located 7 km east of Kroondal and 11 km south-east of Rustenburg and falls within the Rustenburg Local Municipality of the North West Province. The current mining rights of Lanxess cover various portions of the farms Klipfontein 300 JQ, Kroondal 304 JQ and Rietfontein 338 JQ. The extent of this area is 952.5 hectares (ha). 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 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 Brakspruit 299 JQ, Klipfontein 300 JQ, Kroondal 304 JQ, Rietfontein 338 JQ and Spruitfontein 341 JQ. Glencore Operations South Africa (Pty) Ltd (Glencore) (formally known as Xstrata) holds the mining rights for some of these areas which are currently in the legal process of being transferred to Lanxess.

The registered description of the land for the amended application is as follows:

- Portions 95, 96, 97 and 98 of the farm Kroondal 304 JQ;
- The remaining extent of the farm Klipfontein 300 JQ;
- The remaining extent of portion 1 and portions 1, 10, 11, 14, 32 and 34 of the farm Rietfontein 338 JQ;
- Portion 1 of the farm Spruitfontein 341 JQ; and
- The remaining extent of portion 12, the remaining extent of portion 19, portions 17, 18 and 19 and the remaining extent of the farm Brakspruit 299 JQ.

2.3 Mining Activities

Currently the only mining that is taking place is done underground with the ore broken 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.

2.3.1 Opencast Mining

Access to the shallow resource will be by an opencast pit cut 1,374 m in strike length and down to a vertical depth between 50 m and 70 m below the surface. The programme indicates that there will be free digging up to ±14 metres below surface (m.b.s.) where after opencast blasting operations will take over mining 100 m x 300 m block sizes at 10 m cuts (using Load Haul Dump (LHD) loaders with excavators and dump trucks). The opencast 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 opencast pit. Waste rock and topsoil will be stockpiled separately to the south of the opencast area. As the opencast mining progresses, the voids created will be backfilled with overburden from the progressive opencast 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°.

Ore production rate is estimated to be 40,000 tons per month with a Life of Mine (LOM) of five (5) years for the opencast pit.

2.3.2 Underground Mining

The underground mining method 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 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 that are developed from the reef outcrop. Run of Mine (ROM) 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 (tpm) with a total LOM of 14 years.

2.3.3 Mineral Deposit

Lanxess produce four products namely; lumpy ore, metallurgical grade chrome ore, foundry grade chrome ore and chemical grade chrome ore (Table 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;
- 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;
- 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; and
- Chemical grade chrome ore with a typical Cr_2O_3 content of 46% 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.

Table 1: Products and Quantities

Product	Tons / Year	Percentage of Total
Lumpy	324 kt	27%
Foundry Sand	120 kt	20%
Chemical Grade	384 kt	32%
Metallurgical Concentrate	372 kt	31%
Total	**1,200 kt**	**100%**

2.3.4 Processing

The Lanxess Chrome Mine 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 tonnes 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.

All products are sold to external clients. Chemical grade is also sold to other Lanxess business sites for the production of chrome chemicals. A high level block flow diagram of the processing plant is shown in Figure 1 below.

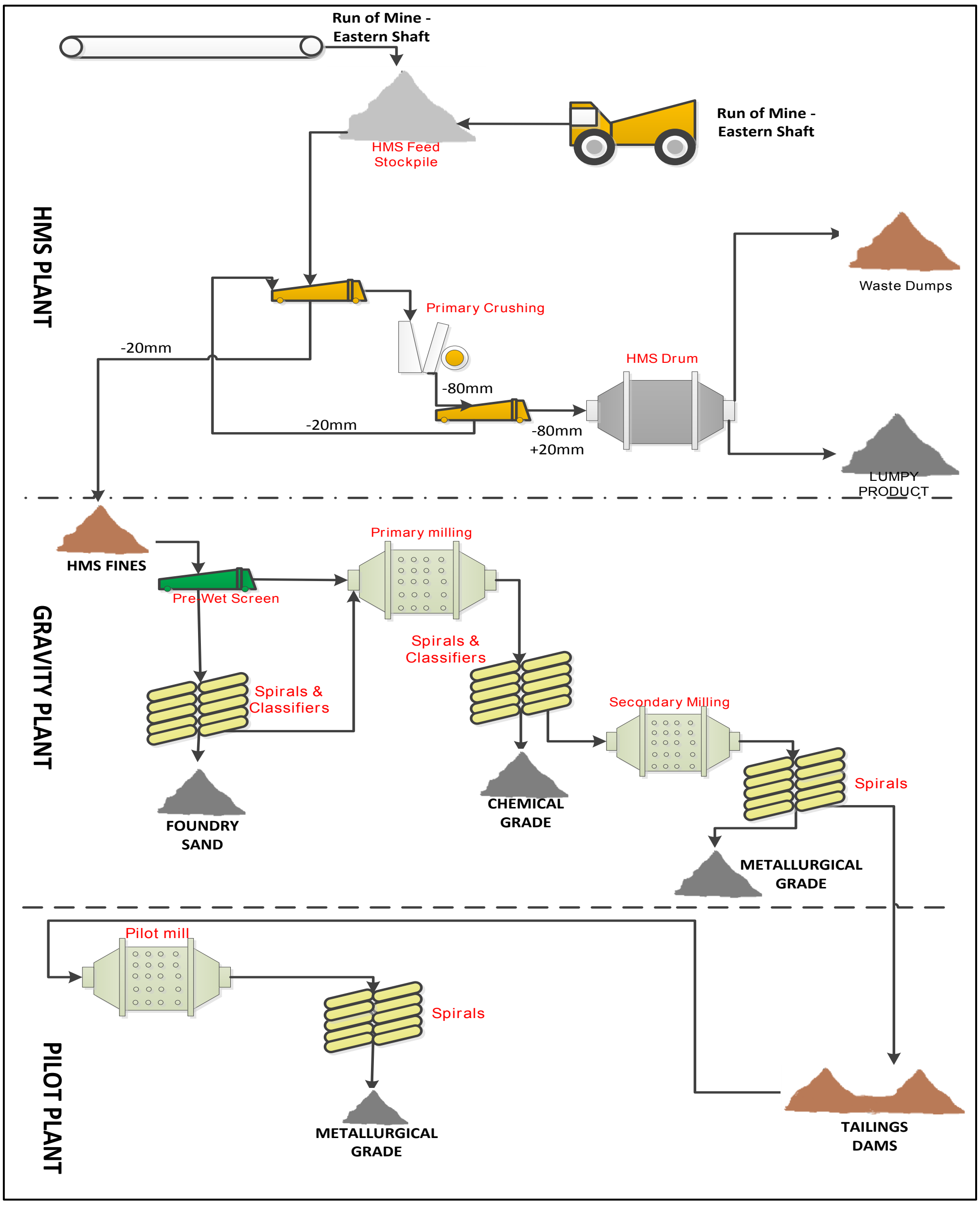

Figure 1: High Level Block Flow Diagram of the Processing Plant

2.4 Infrastructure Requirements

Lanxess is a well-established mine with existing infrastructure which has been operational since 1958. As a result minimal additional infrastructure will be required for the expansion of the activities as the plant has capacity for the proposed 80,000 tpm.

2.4.1 Current Surface Infrastructure

Currently the following infrastructure is in place on the mine and will remain in operation (Table 2).

Table 2: Infrastructure and Activities

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 ■ 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 ■ CO4 ■ CO6	Stockpiling of material before use or transport. (Bunded).
Tailings dams	Tailings material from processing is pumped by pipeline to the tailings dam. Tailings deposition. Waste management facility.

Infrastructure	Associated Activities
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 mine’s employees do not live on the mine property.

2.4.2 Proposed Surface Infrastructure

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

- Haul Roads and Service Road – Approximately 5.5 km of haul roads, 26 m wide to accommodate two lanes of traffic. A service road will be constructed along the boundary fence of the property. These roads will be gravel or tarred;
- Dump – An additional waste rock dump will be required alongside the opencast pit for overburden removed during mining. This proposed dump will measure 62.71 ha;
- Stockpile – An additional topsoil stockpile will be required. This proposed stockpile will measure 17.33 ha; and

- A small workshop, office block and parking area will be built near the area of the opencast pit.

No additional infrastructure is required for the underground areas. The focus of this VIA will therefore be on the opencast project area.

3 Terms of Reference

Digby Wells Environmental (Digby Wells) has been appointed by Lanxess Mining (Pty) Ltd (Lanxess) as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) according to the NEMA, including the associated specialist studies for the proposed Lanxess Chrome Mine Expansion Project, and the required Public Participation Process (PPP). The environmental considerations for the impact assessment phase of the EIA included a VIA for the proposed Lanxess Chrome Mine Expansion Project.

4 Relevant Legislation

The following international, national and regional documents form part of the legislative and policy framework of the VIA.

4.1 International Conventions

The European Landscape Convention (ELC) created by the Council of Europe, was the first international convention to focus exclusively on landscapes. The purpose of this convention is to promote effective management and planning of landscapes. It was signed by the United Kingdom government in 2006 and became binding from 2007. Public documents that explore the impacts of large scale developments, as defined in the ELC, on any landscape should take into account the effects of these developments. A landscape means “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors” i.e. the natural, visual and subjectively perceived landscape, (Contesse, 2011; European Landscape Convention, 2007).

There is no regional or local scale legislation pertaining to mining activities and Visual Impact Assessments (VIAs) exclusively but VIAs are relevant to the International Finance Corporation’s (IFC) Performance Standards and this will be treated as a best practice guideline.

IFC Performance Standard 3: Resource Efficiency and Pollution Prevention is applicable to the VIA. Performance Standard 3 recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional and global levels. For the purposes of this Performance Standard, the term ‘pollution’ is used to refer to both hazardous and non-hazardous chemical pollutants in the solid, liquid, or gaseous phases, and includes other components such as pests, pathogens, thermal discharge to water, GHG emissions, nuisance odours, noise, vibration, radiation, electromagnetic energy and the creation of potential visual impacts including light (IFC, 2012).

The Environmental, Health and Safety Guidelines for Mining therefore need to be considered (World Bank, 2007):

"Mining operations, and in particular surface mining activities, may result in negative visual impacts to resources associated with other landscape uses such as recreation or tourism. Potential contributors to visual impacts include high walls, erosion, discoloured water, haul roads, waste dumps, slurry ponds, abandoned mining equipment and structures, garbage and refuse dumps, open pits, and deforestation. Mining operations should prevent and minimise negative visual impacts through consultation with local communities about potential post-closure land-use, incorporating visual impact assessment into the mine reclamation process. Reclaimed lands should, to the extent feasible, conform to the visual aspects of the surrounding landscape. The reclamation design and procedures should take into consideration the proximity to public viewpoints and the visual impact within the context of the viewing distance. Mitigation measures may include strategic placement of screening materials including trees and use of appropriate plant species in the reclamation phase as well as modification of the placement of ancillary and access roads."

4.2 National Legislation and Policy

At a national level, the following legislative documents potentially apply to the VIA:

- Regulations in Chapter 5 (Integrated Environmental Management) of the NEMA and the Act in its entirety. The Act states that "the State must respect, protect, promote and fulfil the social, economic and environmental right of everyone…" Landscape is both moulded by, and moulds, social and environmental features;
- Section 23(1)(d) of the MPRDA, where it is mentioned that a mining right will be granted if "the mining will not result in unacceptable pollution, ecological degradation or damage to the environment". Visual pollution is a form of environmental pollution and therefore needs to be considered under this section. Holders of rights granted in terms of the MPRDA must at all times give effect to the general objectives of integrated environmental management laid down in Chapter 5 of the NEMA. The Regulations promulgated in terms of the NEMA, with which holders of rights must comply, provide for the assessment and evaluation of potential impacts, and the setting of management plans to mitigate such impacts.
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and related provincial regulations – in some instances there are policies or legislative documents that give rise to the protection of listed sites. The NHRA states that it aims to promote "good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy so that it may be bequeathed for future generations". A holistic landscape whose character is a result of the action and

interaction and/or human factors has strong cultural associations as societies and the landscape in which they live are affected by one another in many ways; and

- Section 17 of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PAA) sets out the purposes of the declaration of areas as protected areas which includes the protection of natural landscapes. Landscapes are defined by the natural, visual and subjectively perceived landscape; these aspects of a landscape are intertwined to form a holistic landscape context.

5 Project Area

The proposed Lanxess Chrome Mine Expansion Project is an extension of the existing Lanxess Chrome Mine situated on the western limb of the Bushveld Igneous Complex. This region is characterised by settlements and agriculture interspersed with mining activities. Plan 1 (Appendix A) illustrates the regional setting of the project area.

The project area falls within the Rustenburg Local Municipality and the Bojanala District Municipality of the North West Province, South Africa. The nearest settlement is Photsaneng situated approximately 2 km north of the project area. The nearest major town is Rustenburg situated approximately 11.9 km west-north-west of the project area.

The closest towns and settlements, as well as their direct distance and direction from the project area are summarised in Table 3. All distances are straight line distances measured from the edge of the project area to the centre of the towns / settlements unless otherwise stated.

Table 3: Closest Towns and Settlements

Name	Type	Direct Distance	Direction
Photsaneng	Other Town	2 km	N
Kroondal	Settlement	4.8 km	W
Marikana	Secondary Town	8.5 km	ENE
Rustenburg	Major Town	11.9 km	WNW
Mooinooi	Other Town	14.7 km	ESE
Maanhaarrand	Settlement	19.3 km	SSE

The N4 national road runs along the southern boundary of the opencast project area. The R104 regional road runs parallel to the N4 approximately 1 km south of the project area. The railway line between Rustenburg and Marikana is approximately 5 km north of the project area with a railway siding approximately 500 m north of the existing Lanxess Chrome Mine.

The opencast project area and surrounds have both an agricultural and a mining sense of place. The project area is bordered by the Lanxess Chrome Mine on the north-west and north and by other existing mining operations on the north-east and east. Agricultural farms and small holdings border the project area on the south-east, south, south-west and western sides.

The proposed Lanxess Chrome Mine Expansion Project is made up of an opencast project area and three underground project areas, namely Amplats Option Area, Kroondal Area and Wonderkop Area. Table 4 provides the sizes of these project areas. The coordinates for the centre of the opencast project area are 25° 44’ 10.651” S and 27° 23’ 45.733” E.

Table 4: Lanxess Chrome Mine Expansion Project Areas

Project Area	Type	Area
Opencast Project Area	Opencast	384.1 ha
Amplats Option Area	Underground	214.4 ha
Kroondal Area	Underground	22 ha
Wonderkop Area	Underground	86 ha

The project area falls within the Crocodile (West) and Marico River catchment. The Brakspruit River originally had its source on the eastern edge of the opencast project area. The neighbouring mine has placed a TSF over river and now only a small wetland area remains near the source. There are no other water features within the opencast project aras. The opencast project area is situated on a spur above several river valleys. These rivers include the Sandspruit River and other tributaries of the Hex River, and the Brakspruit River, Hoedspruit River and other tributaries of the Strekstroom River. There are numerous small farm dams in the surrounding area.

The opencast area consists of agricultural land. The surrounding area is characterised by agriculture and mining. Little of the natural Bushveld and Thornveld vegetation remains. Plan 3 (Appendix A) illustrates the project area.

6 Expertise of the Specialist

A Curriculum Vitae (CV) and declaration of independence is attached in Appendix B.

7 Aims and Objectives

The aim of this VIA is to determine the nature of the project area and the impact of the proposed Lanxess Chrome Mine Expansion Project on the visual / aesthetic character of the surrounding landscape. The following objectives have been identified to achieve this aim:

- Examine aerial photography available for the project area (CD: NGI, 2010);

- Create and examine topographical, slope intensity, slope aspect and viewshed models in ArcGIS;
- Describe the topography and visual / aesthetic character of the receiving environment;
- Determine the size of the viewshed area;
- Identify potential receptors within the viewshed area;
- Determine the potential visual impacts; and
- Recommend measures to mitigate impacts and enhance benefits.

8 Knowledge Gaps

A VIA is open to subjectivity. This subjectivity is due to the different opinions receptors have of a proposed project. A receptor may be partial to the fact that the proposed project is occurring in an area, which becomes a source of economic upliftment for a community, whereas another receptor may view a proposed project as a negative factor which could hamper tourism or recreational activities.

Many factors can enhance or reduce the visual impact of the proposed project. Vegetation near a receptor's viewpoint can greatly reduce that receptor's view of the proposed project. Other factors such as weather / climatic conditions and seasonal change can also affect a receptor's view of the proposed project. It is, therefore, difficult to determine the visual impact of the proposed project from the viewpoint of each individual receptor. Consequently, this report focuses on the size of the viewshed area.

Some infrastructure heights were not available for this study and assumptions were made. These assumptions were based on the heights of infrastructure from similar projects.

The 5 metre contour relief data from CD: NGI did not include contours for any of the mining activities (dumps and TSFs) near the project area. These dumps and TSFs could potentially provide some screening of the proposed project. The contour data was edited and contours were added for these mining activities to produce a more representative topographical model. It was assumed that each bench of the TSFs was 10 metres high and therefore two 5 metre contours were added per bench.

9 Methodology

The VIA was performed using surveyed geographically referenced information and aerial photography, together with the professional opinion of an experienced topography and visual impact assessor.

9.1 Characterisation of Visual Impacts

The expected visual impact of the proposed Lanxess Chrome Mine Expansion Project was categorised based on the type of receiving environment and the type of development as detailed in Table 5 (Oberholzer, 2005). This table provides an indication of the visual impacts that can typically be expected for different types of developments in relation to the nature of the receiving environment. According to Oberholzer (2005), the proposed Lanxess Chrome Mine Expansion Project is classified as a **Category 5 development** (Table 6). The receiving environment can be described as having **low scenic, cultural or historical significance** and it is therefore expected that the proposed Lanxess Chrome Mine Expansion Project will have a **high visual impact** on the environment. This will be verified in the investigation to follow.

Table 5: Categorisation of Expected Visual Impact (adapted from Oberholzer, 2005)

Type of Environment	Type of Development (Low to High Intensity)				
	Category 1 Development	Category 2 Development	Category 3 Development	Category 4 Development	Category 5 Development
Protected / wild areas of international, national or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high, scenic, cultural or historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected
Areas or routes of medium scenic, cultural or historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural or historical significance	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	**High visual impact expected**
Disturbed or degraded sites / run down urban areas / wasteland	Little or no visual impact expected. Possible benefits	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

Table 6: Key to Categorisation of Development (adapted from Oberholzer, 2005)

Type of Development	Examples of Development
Category 1	Nature reserves, nature related recreation, camping, picnicking, trails and minimal visitor facilities
Category 2	Low-key recreation / resort / residential type development, small-scale agriculture / nurseries, narrow roads and small-scale infrastructure
Category 3	Low density resort / residential type development, golf or polo estates, low to medium-scale infrastructure
Category 4	Medium density residential development, sports facilities, small-scale commercial facilities / office parks, one-stop petrol stations, light industry, medium-scale infrastructure
Category 5	High density township / residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll roads, large-scale infrastructure generally. Large-scale development of agricultural land and commercial tree plantations. **Quarrying and mining activities with related processing plants**

9.2 Visual / Aesthetic Character and Topography

A desktop study was conducted to evaluate the topography of the receiving environment and Chief Directorate: National Geospatial Information (CD: NGI) aerial photography (flown in 2010) of the area was examined to determine the surface features. The available vector GIS data were used to determine the relative location of the features surrounding the project area.

A topographical model was created using ArcGIS 3D Analyst Extension. The model was created using 5 metre contour relief data from CD: NGI.

The resultant topographical model was then used to create slope intensity and slope aspect models using the Slope and Aspect Tools of the ArcGIS 3D Analyst Extension. The slope model indicates the slope degree and was classified using the Jenks Natural Breaks method.

The information gathered from the above desktop study forms the basis of this report.

9.3 Viewshed Analysis

The resultant topographical model was used to create a viewshed model using the Viewshed Tool of the ArcGIS 3D Analyst Extension. This viewshed model illustrates the areas from which the proposed project will potentially be visible taking into account the estimated height of the proposed infrastructure (Table 7). The viewshed modelling tool does not work with negative infrastructure heights so all below ground infrastructure (pits and trenches) has been modelled with a height of 0 metres. The infrastructure listed in Table 7 is illustrated on Plan 4 (Appendix A).

Table 7: Infrastructure Height Assumptions for Viewshed Modelling

Infrastructure	Height
Waste Rock Dump	30 m
Topsoil Stockpile	25 m
Site Office	5 m
Berm	2 m
Pit	0 m
Conveyor	0 m
Access Road	0 m
Haul Road	0 m

The concept of viewshed modelling is depicted in Figure 2. The topography denotes whether or not a development will be visible from a receptor. In Figure 2 below the development is only visible from the receptors within the valley and on the slopes of the hills facing it. The development will be hidden from all receptors beyond the first hills.

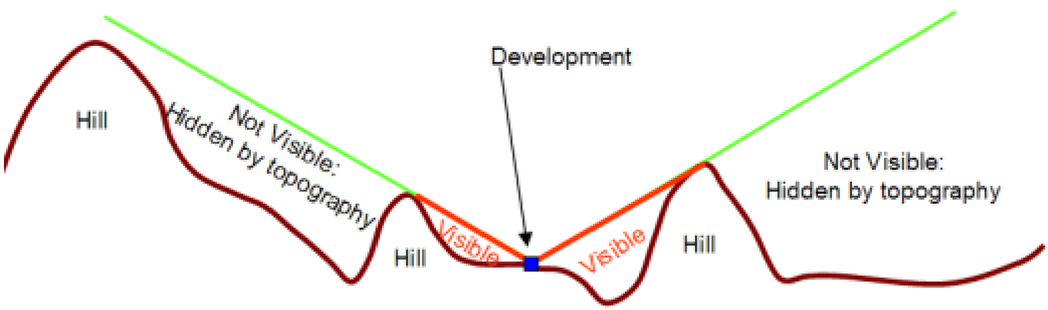

Figure 2: Theoretical Background of Viewshed Modelling

A theoretical viewshed model and a practical viewshed model were created. This viewshed model is based on the topography only and does not take the screening effect of vegetation into account. The very little natural Marikana Thornveld, Moot Plains Bushveld and Norite Koppie Bushveld vegetation remains. The area is dominated with agricultural vegetation which is not expected to provide noticeable screening of the proposed development. The theoretical viewshed model was then refined to a practical viewshed model by dividing the viewshed area into areas that are likely to experience different categories of visual exposure. Visual exposure and visual impact of a development diminishes exponentially with distance (Oberholzer, 2005). The following categories were used for the practical viewshed model:

- 0 – 2 km: Potentially high visual exposure;
- 2 – 4 km: Potentially moderate visual exposure; and
- 4 – 6 km: Potentially low visual exposure.

10 Findings

10.1 Visual / Aesthetic Character and Topography

This section provides the results obtained from the analysis of the topographical, slope intensity and slope aspect models created in ArcGIS.

The topography of the opencast project area is relatively flat with the exception of the rocky hill in the north-western corner and the small rocky outcrops on the eastern side of the project area. The opencast project area is situated on a spur above several river valleys. The surrounding area has an undulating topography with numerous ridges and river valleys. The Magaliesburg mountain range is approximately 3 km south of the opencast project area.

The topographical model indicates that the elevation of the opencast project area increases from 1218 metres above mean sea level (m.a.m.s.l.) on the eastern side to 1279 m.a.m.s.l. on the rocky hill in the north-western corner. Plan 5 (Appendix A) illustrates the topographical model and features of the project area.

The majority of the opencast project area has gentle slopes of less than 2.2°. Isolated steeper slopes of between 2.2° and 12.6° occur on the rocky outcrops along the eastern side of the project area. The steepest slopes occur on the rocky hill in the north-western corner of the project area and range from 12.6° to 31.4°. Plan 6 (Appendix A) illustrates the slope model of the project area.

Due to the undulating topography, the slope aspect / direction of the opencast project area is not in any specific direction. The topography slopes in various different directions as illustrated by the aspect model of the project area (Plan 7, Appendix A).

The undulating topography is expected to provide moderate screening of the proposed development. The receiving environment is characterised by agriculture and mining with little of the natural vegetation (Marikana Thornveld, Moot Plains Bushveld and Norite Koppie Bushveld) remaining. The proposed project is expected to partially blend in with the surrounding mining activity. The agricultural and natural Bushveld and Thornveld vegetation will only provide minimal screening of the proposed development.

10.2 Viewshed Model

A viewshed is a geographical area, defined by the topography, within which a particular feature will be visible (Oberholzer, 2005). The theoretical viewshed model for the proposed Lanxess Chrome Mine Expansion Project is illustrated in Plan 8 (Appendix A). This model was refined to a practical viewshed model (Plan 9, Appendix A) with a buffer of 6 km around the proposed infrastructure and divided into areas that are likely to experience different categories of visual exposure. Due to the nature of the receiving environment it is unlikely that the proposed infrastructure will be noticeable beyond this 6 km buffer. The practical viewshed model depicts the area from which the proposed Lanxess Chrome Mine Expansion Project is likely to be visible. This practical viewshed covers an area of 59.75 km^2. The viewshed areas for the categories are listed in Table 8 below.

Table 8: Viewshed Area per Category

Category	Impact	Viewshed Area
0 – 2 km	Potentially High Visual Exposure	13.07 km^2
2 – 4 km	Potentially Moderate Visual Exposure	19.34 km^2
4 – 6 km	Potentially Low Visual Exposure	27.34 km^2

10.3 Sensitive Receptors

The potential visual receptors identified within the practical viewshed area include the residents of the surrounding farms and small holdings. These visual receptors are indicated as receptor points on Plan 9 (Appendix A). People residing on the outskirts of the town of Photsaneng are also potential visual receptors. These potentially affected areas and the Lanxess Chrome Mine village are indicated by the receptor polygons on Plan 9 (Appendix A).

A total of 334 potential visual receptors were identified within the practical viewshed area. The number of potential visual receptors within each category is shown in Table 9.

Table 9: Number of Potential Visual Receptors per Category

Category	Impact	Number of Receptors
0 – 2 km	Potentially High Visual Exposure	20
2 – 4 km	Potentially Moderate Visual Exposure	146
4 – 6 km	Potentially Low Visual Exposure	168

Road users on the N4 national road, R104 regional road and the secondary and farm roads within the practical viewshed area will also have views of the proposed Lanxess Chrome Mine Expansion Project.

Existing mines and associated mining infrastructure have not been considered as visual receptors.

11 Discussion

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.

11.1 Visibility of the Project

The visibility of the project refers to the viewshed area. Oberholzer (2005) describes this as "the geographic area from which the project will be visible". The visibility of the project is also related to the number of receptors affected. The proposed Lanxess chrome Mine Expansion Project has a **high visibility** as it is visible from a large area (viewshed of approximately 59.75 km^2) with numerous visual receptors.

11.2 Visual Exposure

Visual exposure is "based on the distance from the project area to selected viewpoints" and "tends to diminish exponentially with distance" (Oberholzer, 2005). The proposed Lanxess Chrome Mine Expansion Project has a **moderate exposure** as it will be recognisable to the viewer. This is due to the large area covered by the open pit and the height of the overburden and topsoil stockpiles.

11.3 Visual Sensitivity of the Area

The visual sensitivity of the area refers to "the inherent visibility of the landscape, usually determined by a combination of topography, landform, vegetation cover and settlement pattern" (Oberholzer, 2005). The receiving environment of the proposed Lanxess Chrome Mine Expansion Project has a **moderate visual sensitivity** as there are moderately visible areas in the landscape.

11.4 Visual Sensitivity of Receptors

The visual sensitivity of receptors is dependent on the nature of the receptors. Receptors in residential areas or nature reserves have a high sensitivity while receptors in industrial or mining areas have a low sensitivity. The identified receptors (residents of farms, small holdings and the outskirts of the town of Photsaneng and road users) of the proposed

Lanxess Chrome Mine Expansion Project have a **moderate sensitivity** as there is a combination of residential, agricultural, natural, industrial, mining and degraded areas situated in moderately scenic areas.

11.5 Visual Absorption Capacity (VAC)

The visual absorption capacity (VAC) refers to “the potential of the landscape to conceal the proposed project” (Oberholzer, 2005). The receiving environment of the proposed Lanxess Chrome Mine Expansion Project has a **moderate VAC** because there is partial screening by the topography.

11.6 Visual Intrusion

The visual intrusion of the project refers to “the level of compatibility or congruence of the project with the particular qualities of the area, or its sense of place”. Visual intrusion is “related to the idea of context and maintaining the integrity of the landscape or townscape” (Oberholzer, 2005). The proposed Lanxess Chrome Mine Expansion Project has a **moderate visual intrusion** as it partially fits into the surroundings, but will be clearly noticeable. Although the proposed Lanxess Chrome Mine Expansion Proejct 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 a significant impact on the receiving environment.

12 Impact Assessment

12.1 Assessment Methodology

The methodology utilised to assess the significance of potential impacts is discussed in detail below. The significance rating formula is as follows:

Significance = Consequence x Probability

Where

Consequence = Type of Impact x (Intensity + Spatial Scale + Duration)

And

Probability = Likelihood of an Impact Occurring

In addition, the formula for calculating consequence:

***Type of Impact** = **+1** (Positive Impact) or **-1** (Negative Impact)*

The weight assigned to the various parameters for positive and negative impacts is provided for in the formula and is presented in Table 10. The probability consequence matrix for impacts is displayed in Table 11, with the impact significance rating described in Table 12.

Table 10: Impact Assessment Parameter Ratings

Rating	Intensity		Spatial Scale	Duration	Probability
	Negative Impacts ***(Type of Impact = -1)***	***Positive Impacts*** ***(Type of Impact = +1)***			
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or ecosystem. Persistent severe damage. Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	Noticeable, on-going social and environmental benefits which have improved the livelihoods and living standards of the local community in general and the environmental features.	International The effect will occur across international borders.	Permanent: No Mitigation The impact will remain long after the life of the Project.	Certain / Definite. There are sound scientific reasons to expect that the impact will definitely occur.
6	Significant impact on highly valued species, habitat or ecosystem. Irreparable damage to highly valued items of cultural significance or breakdown of social order.	Great improvement to livelihoods and living standards of a large percentage of population, as well as significant increase in the quality of the receiving environment.	National Will affect the entire country.	Beyond Project Life The impact will remain for some time after the life of a Project.	Almost Certain / Highly Probable It is most likely that the impact will occur.

Rating	Intensity		Spatial Scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread positive benefits to local communities which improves livelihoods, as well as a positive improvement to the receiving environment.	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. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense social benefits to some people. Average to intense environmental enhancements.	Municipal Area Will affect the whole municipal area.	Long Term 6-15 years.	Probable Has occurred here or elsewhere and could therefore occur.

Rating	Intensity		Spatial Scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
3	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some.	Local Extending across the site and to nearby settlements.	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.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by very few of population.	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.

Rating	Intensity		Spatial Scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
1	Limited damage to minimal area of low significance that will have no impact on the environment. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level social and environmental benefits felt by very few of the population.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month.	Highly Unlikely / None Expected never to happen.

Table 11: Probability Consequence Matrix for Impacts

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	**-20**	**-19**	**-18**	**-17**	**-16**	**-15**	**-14**	**-13**	**-12**	**-11**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
	Consequence																																					

Table 12: Significance Threshold Limits

Score	Description	Rating
109 to 147	A very beneficial impact which may be sufficient by itself to justify implementation of the Project. The impact may result in permanent positive change.	**Major (positive)**
73 to 108	A beneficial impact which may help to justify the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and/or social) environment.	Moderate (positive)
36 to 72	An important positive impact. The impact is insufficient by itself to justify the implementation of the Project. These impacts will usually result in positive medium to long-term effect on the social and/or natural environment.	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the social and/or natural environment.	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the social and/or natural environment.	Negligible (negative)
-36 to -72	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the social and/or natural environment.	Minor (negative)

Score	Description	Rating
-73 to -108	A serious negative impact which may prevent the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects.	Moderate (negative)
-109 to -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the Project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects.	Major (negative)

12.2 Identification of Project Activities

The activities associated with the proposed Lanxess Chrome Mine Expansion Project are listed in Table 13 below. The activities highlighted in red are applicable to this VIA.

Table 13: Project Activities

Activity No.	Activity
Construction Phase	
1	The transportation of construction material to the project site via national, provincial and local roads.
2	Storage of fuel, lubricant and explosives in temporary facilities for the duration of the construction phase.
3	Site clearance and topsoil removal prior to the commencement of physical construction activities across the project area.
4	The construction of waste rock dumps.
5	The construction of topsoil stockpiles.
6	The establishment of the initial boxcut and access ramps to the open-pit mining areas.
7	The establishment of underground access shaft.
8	The construction of haul roads on site.
9	The construction of the access or service road.
10	The construction of the hard park area (this is made up of the workshop, office block and parking lot).
Operational Phase	

Activity No.	Activity
11	Drilling and blasting of the overburden rock for easy removal by excavators and dump trucks.
12	Dumping of waste rock and maintenance of waste rock dump.
13	Removal and loading of ore onto trucks (O/C) or conveyor (U/G) to the plant.
14	Continuing operation of existing processing plant (crusher, settler, gravity plant and reclamation plant).
15	Storage of fuel in diesel tanks, as well as lubricant and explosives in facilities for the duration of the project.
16	Vehicular activity on the proposed roads and maintenance activities.
17	The operation of the TSF (dirty water from stormwater and dewatering mining activities) and the connected return water dam.
18	Continuing operation and maintenance of the stockpiles, including topsoil and ROM stockpiles.
19	Waste and sewage generation and disposal.
20	Maintenance of secondary infrastructure (offices, parking).
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.
Decommissioning Phase	
22	Removal of surface infrastructure (plant machinery, shafts, conveyors).
23	Decommissioning of services (if necessary, depending on post land use) including waste treatment and removal, power and water facilities.
24	Rehabilitation of roads and cleared areas (offices and workshop area).
25	Removal of fuel, lubricants and explosives.
26	Safe closure of shafts and mine access ramps.

Activity No.	Activity
27	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.
28	Waste handling of scrap metal and used oil as a result of the decommissioning phase will be undertaken.
Post-Closure Phase	
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 discard dumps.

12.3 Visual Impact Assessment

The project activities listed in Table 13 will be rated according to the impact they will have on the receiving environment, i.e. the environment before development. Negative visual impacts decrease the visual character of the pre-development environment while positive visual impacts increase the visual character of the pre-development environment. Neutral visual impacts assist to minimise the negative visual impacts of a development but don't result in a positive visual impact. A positive visual impact only occurs when an area is rehabilitated to a state that is better than the state of the pre-development environment, e.g. a mining area on previously agricultural land is rehabilitated to an area of natural vegetation and all visible signs of agriculture and mining area removed. Positive visual impacts rarely occur.

12.3.1 Construction Phase

The construction phase is characterised by site development and infrastructure construction. This includes transportation of construction material, temporary storage of fuel, lubricant and explosives, site clearance and topsoil removal, construction of waste rock dumps and topsoil stockpiles, establishment of the initial boxcut and access ramps to the open-pit mining areas, establishment of the underground access shaft, construction of haul roads and access or service road and construction of the hard park area. The establishment of infrastructure and the related construction activities will draw attention to the project area making receptors aware of the development. The construction phase will have negative visual impacts on the receiving environment. The transportation of construction material and the temporary storage of fuel, lubricant and explosives will have a minor visual impact. The site clearance and topsoil removal will occur over large parts of the project area and will have a moderate visual impact. The surface infrastructure is small scale and will have a moderate visual impact. The most significant impact during the construction phase is the establishment of the initial boxcut and access ramps to the open pit mining areas and the construction of waste rock dumps and topsoil stockpiles. This will result in a scar on the landscape.

Activity No. 1: 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	■ 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 No. 3: 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	■ 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 No. 4: 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	■ 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 No. 5: 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	■ 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 No. 6: 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	▪ 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 No. 7: 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	▪ 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 No. 8: 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 No. 9: 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

<table>
<tr><th colspan="6">Activity No. 10: The construction of the hard park area (this is made up of the workshop, office block and parking lot).</th></tr>
<tr><th>Criteria</th><th colspan="5">Details / Discussion</th></tr>
<tr><td>Description of Impact</td><td colspan="5">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.</td></tr>
<tr><td>Mitigation Required</td><td colspan="5">■ 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.</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>2</td><td>3</td><td>-2</td><td>6</td><td>-42</td></tr>
<tr><td>Post-Mitigation</td><td>2</td><td>3</td><td>-2</td><td>5</td><td>-35</td></tr>
</table>

12.3.2 Operational Phase

The operational phase is characterised by mining of chrome, operation and maintenance of the dumps and stockpiles, water management, waste management and concurrent rehabilitation. This phase will have both negative and neutral visual impacts; however, the negative impacts far outweigh the neutral impacts. Waste and water management will have a minor visual impact.

The most significant visual impact during the operational phase is the mining of chrome. Drilling and blasting of the overburden rock and removal of the ore will have a major negative visual impact. The resultant open pit will have a severe negative visual impact. Concurrent rehabilitation by replacement of overburden and topsoil, as well as re-vegetation will have a minor neutral impact on the receiving environment. It is a step in the right direction but will not significantly affect the overall negative visual impact of opencast mining.

Activity No. 11: 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	■ 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 No. 12: 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	■ 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 No. 13: 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	▪ 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 No. 16: Vehicular activity on the proposed roads and maintenance activities.					
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	■ 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 No. 18: 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	■ 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

<table>
<tr><th colspan="6">Activity No. 21: 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.</th></tr>
<tr><th>Criteria</th><th colspan="5">Details / Discussion</th></tr>
<tr><td>Description of Impact</td><td colspan="5">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.</td></tr>
<tr><td>Mitigation Required</td><td colspan="5">▪ Backfill as much of the open pit area as possible;
▪ Spread topsoil over the backfilled area; and
▪ Re-vegetate the backfilled area.</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>

12.3.3 Decommissioning Phase

The decommissioning phase is characterised by demolition of infrastructure and rehabilitation of the disturbed areas and final void. This phase will have mainly neutral visual impacts on the receiving environment. The surface infrastructure is relatively small scale and its demolition and removal will have a minor neutral impact. The spreading of topsoil, profiling and contouring, and re-vegetation will have a moderate neutral impact. Rehabilitation of the final void will have a neutral visual impact. The open pit will be partly filled with overburden. There will not be enough overburden to fill the pit entirely so a void will always remain. This partial rehabilitation of the final void will have a neutral visual impact.

Activity No. 22: 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 No. 24: 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	■ 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.*				

<table>
<tr><th colspan="6">Activity No. 27: 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.</th></tr>
<tr><th>Criteria</th><th colspan="5">Details / Discussion</th></tr>
<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">■ 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>

12.3.4 Post-Closure Phase

The post-closure phase is characterised by continuous monitoring and rehabilitation. This phase will have a neutral visual impact on the receiving environment. The project area needs to be returned to a state similar to the pre-mining state.

Activity No. 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 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	■ 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.*				

13 Cumulative Impacts

The Rustenburg area is characterised by agriculture, mining and industry with little natural bushveld vegetation remaining. The proposed Lanxess Chrome Mine Expansion Project is bordered on the north-west and north by the existing Lanxess Chrome Mine and by other existing mining operations on the north-east and east.

The numerous nearby mines have begun altering the agricultural sense of place to one of mining and industry. The visibility of these large developments has resulted in a loss of scenic character and it is expected that the proposed Lanxess Chrome Mine Expansion Project will add to these existing impacts by increasing the visual disturbance on the receiving environment.

14 Mitigation Measures and Management Plan

The Environmental Management Plan (EMP) has been described according to the project activities to provide an understanding of what objectives and recommended management measures are required to minimise the environmental impacts arising from these activities. The management measures are described in Table 14.

Table 14: Mitigation and Management Plan

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Construction Phase										
Activity 1: The transportation of construction material to the project site via national, provincial and local roads.	Visual	■ To minimise the negative visual impact caused by vehicular activity to transport construction material.	■ 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.	Weekly	N/A	Mining Plan Air Quality Plan	Construction	Mining Contractor	Negligible (negative)	Negligible (negative)
Activity 3: Site clearance and topsoil removal prior to the commencement of physical construction activities across the project area.	Visual	■ To minimise the negative visual impact caused by vegetation and topsoil removal.	■ Vegetation and topsoil should only be removed when and where necessary; and ■ Topsoil stockpiles should be vegetated.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Minor (negative)	Minor (negative)
Activity 4: The construction of waste rock dumps.	Visual	■ To minimise the negative visual impact caused by stockpiling overburden.	■ 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.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Minor (negative)	Minor (negative)

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 5: The construction of topsoil stockpiles.	Visual	■ To minimise the negative visual impact caused by stockpiling topsoil.	■ 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.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Minor (negative)	Minor (negative)
Activity 6: The establishment of the initial boxcut and access ramps to the open-pit mining areas.	Visual	■ To minimise the negative visual impacts caused by the establishment of the initial boxcut and access ramps to the open pit mining areas.	■ Only remove overburden when and where necessary; and ■ Apply dust suppression techniques to limit the dust created by blasting.	Weekly	N/A	Mining Plan Air Quality Plan	Construction	Mining Contractor	Moderate (negative)	Minor (negative)

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 7: The establishment of underground access shaft.	Visual	■ To minimise the negative visual impacts caused by the establishment of the underground access shaft.	■ 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.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Negligible (negative)	Negligible (negative)
Activity 8: The construction of haul roads on site.	Visual	■ To minimise the negative visual impact caused by the construction haul roads on site.	■ Do not create numerous haul roads alongside each other.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Negligible (negative)	Negligible (negative)
Activity 9: The construction of the access or service road.	Visual	■ To minimise the negative visual impact caused by the construction of the access or service road.	■ Do not create numerous roads alongside each other.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Negligible (negative)	Negligible (negative)

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 10: The construction of the hard park area (this is made up of the workshop, office block and parking lot).	Visual	■ To minimise the negative visual impact caused by the construction of surface infrastructure; and ■ To minimise the negative visual impact caused by construction area lighting at night.	■ 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.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Minor (negative)	Negligible (negative)
Operational Phase										

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 11: Drilling and blasting of the overburden rock for easy removal by excavators and dump trucks.	Visual	▪ To minimise the negative visual impact caused by the removal of overburden by drilling and blasting; ▪ To minimise the negative visual impact caused by overburden stockpiling; and ▪ To minimise the negative visual impact caused by dust from the blasting of overburden.	▪ 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.	Weekly	N/A	Mining Plan Air Quality Plan	Operational	Mining Contractor	Moderate (negative)	Minor (negative)

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 12: Dumping of waste rock and maintenance of waste rock dump.	Visual	■ To minimise the negative visual impact caused by stockpiling of overburden; ■ To minimise the negative visual impact caused by dust from the stockpiles; and ■ To minimise the negative visual impact caused by infrastructure and mining area lighting at night.	■ 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.	Weekly	N/A	Mining Plan Air Quality Plan	Operational	Mining Contractor	Minor (negative)	Minor (negative)
Activity 13: Removal and loading of ore onto trucks (O/C) or conveyor (U/G) to the plant.	Visual	■ To minimise the negative visual impact caused by the removal of ore; and ■ To minimise the negative visual impact caused by infrastructure and mining area lighting at night.	■ 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.	Weekly	N/A	Mining Plan	Operational	Mining Contractor	Moderate (negative)	Minor (negative)

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 16: Vehicular activity on the proposed roads and maintenance activities.	Visual	■ To minimise the negative visual impact caused by vehicular activity on the haul roads; and ■ To minimise the negative visual impact caused by dust from vehicular activity.	■ 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.	Weekly	N/A	Mining Plan Air Quality Plan	Operational	Mining Contractor	Minor (negative)	Negligible (negative)

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 18: Continuing operation and maintenance of the stockpiles, including topsoil and ROM stockpiles.	Visual	▪ To minimise the negative visual impact caused by stockpiling of topsoil, and ROM; ▪ To minimise the negative visual impact caused by dust from the stockpiles; and ▪ To minimise the negative visual impact caused by infrastructure and mining area lighting at night.	▪ 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.	Weekly	N/A	Mining Plan Air Quality Plan	Operational	Mining Contractor	Minor (negative)	Minor (negative)

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 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.	Visual	■ To increase the neutral visual impact caused by the replacement of overburden and topsoil, as well as re-vegetation as mining progresses.	■ Backfill as much of the open pit area as possible; ■ Spread topsoil over the backfilled area; and ■ Re-vegetate the backfilled area.	Monthly	N/A	Rehabilitation Plan	Operational	Environmental Officer	Moderate (negative)	*This is a positive impact with a neutral net benefit.*
Decommissioning Phase										
Activity 22: Removal of surface infrastructure (plant machinery, shafts, conveyors).	Visual	■ To increase the neutral visual impact caused by the removal of infrastructure.	■ Ensure that all unnecessary infrastructure is demolished and removed from the site.	Monthly	N/A	Rehabilitation Plan	Decommissioning	Environmental Officer	Minor (negative)	*This is a positive impact with a neutral net benefit.*

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 24: Rehabilitation of roads and cleared areas (offices and workshop area).	Visual	■ To increase the neutral visual impact caused by rehabilitation of the roads and cleared areas; ■ To increase the neutral visual impact caused by the spreading of topsoil; ■ To increase the neutral visual impact caused by profiling and contouring to create a free-draining topography; and ■ To increase the neutral visual impact caused by re-vegetation of the rehabilitated areas.	■ 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.	Monthly	N/A	Rehabilitation Plan	Decommissioning	Environmental Officer	Negligible (negative)	*This is a positive impact with a neutral net benefit.*

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 27: 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	■ To increase the neutral visual impact caused by rehabilitation of the final void; ■ To increase the neutral visual impact caused by the spreading of topsoil; ■ To increase the neutral visual impact caused by profiling and contouring to create a free-draining topography; and ■ To increase the neutral visual impact caused by re-vegetation of the rehabilitated areas.	■ 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.	Monthly	N/A	Rehabilitation Plan	Decommissioning	Environmental Officer	Moderate (negative)	*This is a positive impact with a neutral net benefit.*
Post-Closure Phase										

Project Activities	Receiving Environment	Objectives	Management and Mitigation Measures	Frequency	Legal Requirements	Recommended Action Plans	Duration	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 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 discard dumps.	Visual	▪ To increase the neutral visual impacts of post-closure rehabilitation.	▪ 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.	Monthly	N/A	Rehabilitation Plan	Post-Closure	Environmental Officer	Moderate (negative)	*This is a positive impact with a neutral net benefit.*

14.1 General Mitigation

According to Bush et al (1979), vegetation screening is the best mitigation measure to conceal a development. Figure 3 illustrates the screening effect of vegetation. It is recommended that any vegetation which may potentially conceal the proposed development be left undisturbed, especially on the project boundary and around infrastructure. Vegetation left undisturbed along the perimeter of the project has the ability to conceal the proposed infrastructure from nearby receptors. Figure 4 illustrates the effect of cleared vegetation allowing direct views of the proposed infrastructure.

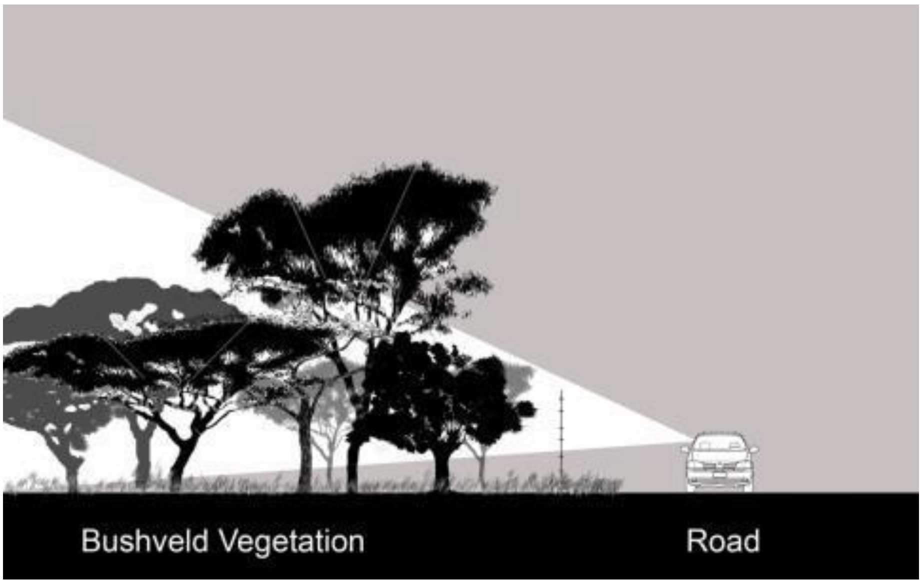

Figure 3: Screening Effect of Vegetation

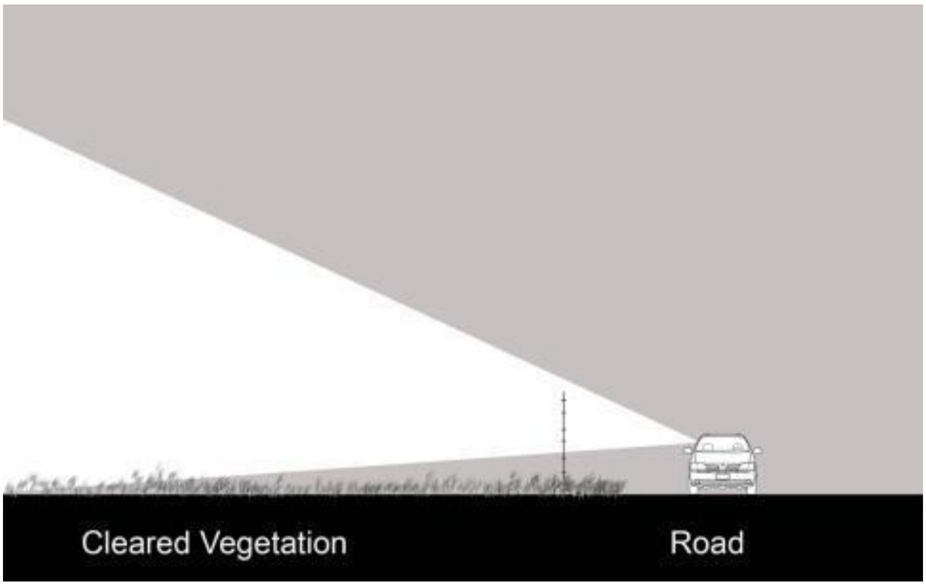

Figure 4: Effect of Cleared Vegetation

Other general mitigation measures that should be implemented where possible include:

- As much existing vegetation as possible should be retained, specifically bushes and trees if present. This will assist to conceal the development;
- Areas susceptible to dust should be frequently wetted by means of a water bowser. It is extremely important to suppress the visual aspects of dust to avoid creating the impression of a polluting industry;
- Vehicles should keep to the recommended speed limit, so as to reduce the creation of dust and attention;
- Down lighting should be implemented to minimise light pollution at night; and
- Grievances from receptors relating to topographical and visual aspects should be monitored and addressed.

15 Monitoring Programme

The following monitoring activities should be undertaken on a monthly basis for the life of the project:

- Dust monitoring as per the Air Quality Monitoring Plan;
- Vegetation screens need to be maintained and protected against fire and utilisation of the vegetation for fire wood, etc.; and
- Grievances from receptors must be monitored and addressed through a Grievance Mechanism.

16 Recommendations

It is recommended that the mitigation measures detailed in Table 14 above 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.

17 Conclusion

The proposed Lanxess Chrome Mine Expansion Project will have negative visual impacts on the receiving environment, but these impacts can be reduced by implementing various mitigation measures. The most important of these is rehabilitation with the emphasis being on re-contouring the site and reconstructing the surface water and drainage lines. The success of this rehabilitation will influence the overall long term impact of the proposed project on the topography and visual / aesthetic character of the receiving environment.

The receiving environment of the proposed Lanxess Chrome Mine Expansion Project has a moderate visual sensitivity as there are moderately visible areas in the landscape. The topography of the project area and surrounds is undulating and this undulating topography is expected to provide moderate screening of the proposed development. The receiving environment is characterised by agriculture and mining with little of the natural vegetation (Marikana Thornveld, Moot Plains Bushveld and Norite Koppie Bushveld) remaining. The proposed project is expected to partially blend in with the surrounding mining activity. The agricultural and natural Bushveld and Thornveld vegetation will only provide minimal screening of the proposed development.

The theoretical viewshed model for the proposed Lanxess Chrome Mine Expansion Project was refined to a practical viewshed model with a buffer of 6 km around the proposed infrastructure and divided into areas that are likely to experience different categories of visual exposure. Due to the nature of the receiving environment it is unlikely that the proposed infrastructure will be visible beyond this 6 km buffer. The practical viewshed model depicts the area from which the proposed Lanxess Chrome Mine Expansion Project is likely to be visible. This practical viewshed covers an area of 59.75 km^2.

The proposed Lanxess Chrome Mine Expansion Project has 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 Lanxess Chrome Mine Expansion 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 a significant impact on the receiving environment.

The receiving environment and receptors of the proposed Expansion Project have a moderate sensitivity. The receiving environment has a moderate VAC because there is partial screening by the topography. The proposed Expansion Project will therefore have a moderate visual impact on the receiving environment.

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Appendix A: Plans

Plan 1: Regional Setting

Plan 2: Local Setting

Plan 3: Project Area

Plan 4: Proposed Opencast Infrastructure

Plan 5: Topography

Plan 6: Slope Model

Plan 7: Aspect Model

Plan 8: Theoretical Viewshed Model

Plan 9: Practical Viewshed Model

Appendix B: CV and Declaration of Independence