NEMA EIA

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED ELANDSDRIFT OPENCAST CHROME MINE ON PORTIONS 63, 64, 65, 69, 111 AND 140

OF THE FARM ELANDSDRIFT 467 JQ, NORTH WEST

NW DEDECT REF: NWP/EIA/81/2013NW
ENVASS REF: 050-12_13

Submitted to:

The North West Department of Economic Development, Environment, Conservation and Tourism (NW DEDECT)
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114 Chris Hani Street
Potchefstroom
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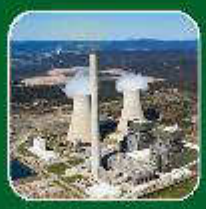


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INTRODUCTION AND PROJECT DESCRIPTION

The Elandsdrift Opencast Mine is situated on Portions 63, 64, 65, 69, 111 and 140 of the Farm Elandsdrift 467JQ, North West Province within the jurisdiction of the Madibeng Local Municipality. The proposed site is 34 km East of Rustenburg along the R27 road; the nearest town is Mooinooi approximately 2.1km away. The mineral to be mined is chromite and in particular the Middle Group 1, and Middle Group 2 (MG1 and MG2) chromitite seams.

The opencast mining area stretches over a strike length of some 3 624 meters. The opencast mining area has been sub-divided into four main pits based on geological disturbances or previously mined areas. Pit 1 is located on the western boundary of Elandsdrift and the pits progress to the east where the final pit, Pit 4 is located on the eastern boundary of the farm.

Key assumptions with respect to project timing used in constructing the financial model are illustrated in the four production profiles of the pits.

The North West Department of Economic Development, Environment, Conservation and Tourism (NW DEDECT), on 20 August 2014, accepted the Scoping Report and NW DEDECT accordingly advised the Environmental Assessment Practitioner (EAP), Environmental Assurance (Pty) Ltd [ENVASS] to proceed with the steps as contemplated in the Plan of Study (PoS) for Environmental Impact Assessment (EIA), in terms of Regulation 31 (1) (a) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA) EIA Regulations, 2010, including the public participation process for EIA referred to in Regulation 28 (h) (i – iv) and prepare the EIA report in respect of the proposed activity.

LEGISLATIVE REQUIREMENTS

National Environmental Management Act (no. 107 of 1998) [as amended]:

The proposed development requires compliance with the EIA Regulations of 2010, promulgated in terms of the National Environmental Management Act, Act 107 of 1998 [as amended]. The proposed activity requires a Scoping and EIA process as listed activities 9, 13, and 22 under Government Notice No R. 544 as well as listed activities 15 and 20 of the EIA 2010 Regulations are triggered.

National Water Act, 1998 (Act 36 of 1998) [as amended]:

The proposed development also requires compliance with the National Water Act, 1998 (Act 36 of 1998) [as amended] (NWA). An application for an Integrated Water Use Licence (IWUL) in terms of Section 21 to undertake the following activities is being applied for:

- Section 21(a) Taking water from a water resource;
- Section 21(b) Storing water;
- Section 21(g) Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

The requirements of the following legislation have also been considered:

- Constitution of South Africa (Act No. 108 of 1996) [as amended];
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) [as amended];
- Alien and Invasive Species Regulations (Government Notice 598 of 2014) and the Alien and Invasive Species List, 2014 in terms of NEMBA (Government Notice 599 of 2014)
- National Heritage Resources Act (Act No. 25 of 1999);

- National Environmental Management: Air Quality Act (No. 39 of 2004) [as amended];
- National Dust Control Regulations, 2013 (Government Notice 827 of 2013)
- National Environmental Management Waste Act (No. 59 of 2008) [as amended];
- Minerals and Petroleum Resources Development Act (No. 28 of 2002) [as amended];
- Conservation of Agricultural Resources Act (no. 43 of 1983);
- National Veld and Forrest Fire Act (no. 101 of 1198);
- Mine Health and Safety Act (No. 29 of 1996);
- Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended]
- Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995); and
- All relevant local, provincial and national guidelines, policies and frameworks and local and provincial legislation.

ALTERNATIVES

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

For the purpose of this application, the following Alternatives were investigated:

- Location;
- Activity;
- Design;
- Demand;
- Timing; and
- No-go.

PUBLIC PARTICIPATION

Formal notification of the application

The project was announced as follows:

Newspaper advertisement

Newspaper advertisements were published in:

- Rustenburg Herald: 19 October 2013;
- Rustenburg Herald: 22 November 2013;
- Platinum Weekly: 15 November 2013; and
- And re-advertised in the Rustenburg Herald informing stakeholders of the new reference number and the availability of the Scoping report on 7 March 2014.

(Refer to the Public Participation Report as per Annexure 6).

Site notice placement

In order to inform surrounding communities and adjacent landowners of the proposed development, 6 site notices were erected on site and at visible and accessible locations close to the site (Refer to the Public Participation Report as per Annexure 6).

Written notification

I&AP's and other key stakeholders, were directly informed of the proposed development by e-mail/ fax/ letter on 30 October 2013. The Background Information Document (BID) and Registration and Comment sheets were also supplied to all parties. I&APs were given 30 days to comment and / or raise issues of concern regarding the proposed development. The commenting period expired on 3 November 2013. (Refer to the Public Participation Report as per Annexure 6).

Public / open house meetings

A public / open house meeting was held on 27 November 2013 and on 8 April 2014 (16:00-18:00) at Elandskraal Primary. All Interested and Affected parties (I&APs) were invited and formally notified.

Release of the draft and final scoping reports and draft EIA report

The Draft Scoping Report (DSR) and Plan of Study (PoS) were released for public review and comment for 40 calendar days (17 March 2014 to 18 May 2014.). Additional days were added to the commenting period in order to compensate for the March and April public holidays. Hardcopies of the DSR were submitted to all Organs of State and relevant authorities. In addition a hard copy was available at the Marikana Public library (Tel: 014 572 3611) and the report was also available for download on the ENVASS website (www.envass.co.za).

The Final Scoping Report (FSR) and PoS have been released for public review for 21 days as from 10 June 2014 to 30 June 2014 and was made available in the same manner as the DSR**.**

The Draft EIA and EMP were released for public review and comment for 40 calendar days (11 November 2014 - 9 January 2015). Additional days were added to the commenting period in order to compensate for public holidays. Hardcopies of the document were submitted to all Organs of State and relevant authorities. In addition a hard copy was placed at the Samancor Western Chrome Mine's Security Office and the report was also available on the ENVASS website (www.envass.co.za).

Next phases

The Final EIA and EMP are herewith released for public review and comment for 21 calendar days ***(13 March 2015 – 2 April 2015)***. Hardcopies of the document are submitted to all Organs of State and relevant authorities. In addition a hard copy is available at the Samancor Western Chrome Mine's Security Office and the report is also available for download on the ENVASS website (www.envass.co.za).

IMPACT STATEMENT

The purpose of this report is to assess the identified potential impacts associated with the proposed development. Potential impacts were identified in consultation with I&APs, and through the technical expertise and experience of ENVASS. The report sought to identify and assess the impacts of the proposed development on the biophysical environment and socio-economic status of the area and the probability of the impacts occurring. The proposed new chrome mine can pose various risks to the environment as well as the residents in the vicinity of the development, although these risks are likely to be limited in its extent.

PREFERRED ALTERNATIVE (CONSTRUCTION PHASE)

NATURE		DESCRIPTION OF IMPACT	POST-MITIGATION
Geological and Soils		Loss of topsoil and soil erosion through vegetation clearance, wind and stormwater.	Very low (-)
		Soil compaction by heavy duty vehicles	Low (-)
		Contamination of soils through: • Indiscriminate disposal of construction waste; and • Accidental spillage of chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles and other chemicals from construction activities e.g. paints.	Low (-)
Agricultural potential and land capability		Loss of soil resources for agricultural and other land uses.	Low (-)
		Possibility of "hot" work (e.g. welding) and workers causing veld fires destroying veld and loss of flora and fauna on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)
		Altered landforms due to construction of roads and excavation.	Very Low (-)
Existing Land Use of Surrounding Properties		Impact of blasting on existing infrastructure on surrounding land.	Low (-)
Hydrology	Surface Water and Groundwater	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality during the construction phase.	Very Low (-)
		Contamination of stormwater runoff and groundwater, caused by: • Spills and leaks of cement; • Sediment release; • Chemical toilets; • Chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles; • Indiscriminate storage and disposal of hazardous waste; • Other chemicals from construction activities e.g. paints; and • Effluent discharges, due to a lack of stormwater management.	Very Low (-)
		Altered drainage patterns and stormwater runoff flows, especially due to vegetation clearance	Very Low (-)
		Dewatering of the groundwater aquifer.	Low (-)
Biodiversity	Flora and Fauna	Decrease in biodiversity on the study and surrounding area.	Low (-)
		Spill-over impacts, which may occur on adjacent ecological systems especially the sensitive riparian area.	Medium (-)
		Spreading of alien and invasive species	Low (-)
		Impact on natural migratory routes and faunal dispersal patterns.	Medium (-)
		Disturbance of fauna through noise, light and dust pollution and hunting, trapping and killing of fauna.	Low (-)

NATURE	DESCRIPTION OF IMPACT	POST-MITIGATION
Archaeological/Heritage Resources	Potential for alteration of archaeological, historical and paleontological resources, should it be discovered during the construction phase.	Very Low (-)
Visual and Lighting	Visibility from sensitive receptors / visual scarring of the landscape as a result of the construction activities.	Medium (-)
	Visibility of solid domestic waste, building rubble and dust.	Very Low (-)
	Impact of security lighting on surrounding landowners and animals.	Very Low (-)
Noise and Vibration	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the operation of construction vehicles and equipment.	Very Low (-)
	Disturbance due to vibrations caused by construction vehicles and blasting.	Very Low (-)
Air Quality	Increased dust pollution due to vegetation clearance as well as construction vehicles and activities.	Very Low (-)
	Settling of dust on the surrounding area and pasture for livestock may impact on livestock.	Very Low (-)
	Windborne dust (soil), vehicle fumes and stockpile particulate matter of PM_{10} and lower which alters air quality and pose a health risk.	Low (-)
Waste (including hazardous materials)	Generation of additional general waste/ litter / building rubble and hazardous material during the construction phase.	Low (-)
	Indiscriminate disposal of waste could pollute natural resources and ecosystems and pose a risk of injury and death of animals and people.	Very Low (-)
Traffic	The change in the traffic patterns as a result of traffic entering and exiting the proposed mine on the surrounding road infrastructure and existing traffic.	Low (-)
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, busses and other heavy vehicles.	Low (-)
Health and Safety	Possibility of construction activities and workers causing veld fires, which can potentially cause injury and or loss of life to construction workers and surrounding landowners, visitors and workers.	Very Low (-)
	Increased risk to public health and safety: Dangerous areas and construction activities including blasting, pose health risks and possible loss of life to construction workers and visitors to the site.	Very Low (-)
	Security risks: Trespassing of construction workers on adjacent properties and possible crime.	Very Low (-)
	Spreading of diseases such as diarrhoea, HIV and TB.	Low (-)

NATURE	DESCRIPTION OF IMPACT	POST-MITIGATION
Socio-economic	Creation of short term employment opportunities for the local communities, during the construction phase.	Medium (+)
	Sourcing supplies from local residents and businesses.	Medium (+)

PREFERRED ALTERNATIVE (OPERATIONAL PHASE)

NATURE		DESCRIPTION OF IMPACT	SIGNIFICANCE POST-MITIGATION
Geological and Soils		Loss of topsoil, soil erosion and soil compaction by heavy duty vehicles on site.	Very low (-)
		Contamination of soils through: • Indiscriminate disposal of waste; and • Accidental spillage of chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from vehicles and other chemicals from operational and maintenance activities e.g. paints.	Low (-)
		Flooding of opencast pit.	Low (-)
Agricultural potential and land capability		Possibility of "hot" work (e.g. welding) and workers causing veld fires destroying veld and animals on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)
Existing Land Use		Blasting may disturb infrastructure on surrounding land.	Low (-)
Hydrology	**Surface Water and Groundwater**	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality during the operational phase.	Very Low (-)
		Contamination of stormwater runoff and groundwater, caused by: • Spills and leaks of cement; • Sediment release; • Chemical toilets; • Chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from mining vehicles; • Indiscriminate storage and disposal of hazardous waste; • Other chemicals from maintenance activities e.g. paints; and • Effluent discharges, due to a lack of stormwater management.	Very Low (-)
		Altered drainage patterns and stormwater runoff flows.	Very Low (-)
		Dewatering on the groundwater aquifer	Low (-)
		Acid Mine Drainage	Low (-)
		Seepage from product stockpiles and from mining operations could cause a contamination plume affecting the underground resources.	Low (-)

NATURE		DESCRIPTION OF IMPACT	SIGNIFICANCE POST-MITIGATION
Biodiversity	Flora and Fauna	Decrease in biodiversity on the study and surrounding area.	Low (-)
		Spill-over impacts, which may occur on adjacent ecological systems.	Low (-)
		Spreading of alien and invasive species	Low (-)
		Impact on natural migratory routes and faunal dispersal patterns.	Medium (-)
Archaeological/Heritage Resources		Potential for alteration of archaeological, historical and paleontological resources, should it be discovered during the operational phase.	Very Low (-)
Visual and Lighting		Visibility from sensitive receptors / visual scarring of the landscape and impact on 'Sense of Place' as a result of the visibility of the mining site including stockpiles, waste dumps and activities.	Medium (-)
		Visibility of solid domestic, dust and operational waste.	Very Low (-)
		Impact of security lighting on surrounding landowners and animals.	Very Low (-)
Noise and Vibration		Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the operation of the mine.	Very Low (-)
		Disturbance due to vibrations caused by vehicles and blasting.	Low (-)
Air Quality		Increased dust pollution due to stockpiles and vehicles on gravel roads as well as other mining activities.	Very Low (-)
		Settling of dust on the surrounding area and pasture for livestock, may impact livestock.	Very Low (-)
		Windborne dust (soil and ore fines) as well as vehicle fumes and particulate matter of PM_{10} and smaller, altering air quality.	Very Low (-)
Waste (including hazardous materials)		Generation of additional general waste/ litter / building rubble and hazardous material during the operational phase.	Low (-)
		Indiscriminate disposal of waste could pollute natural resources and ecosystems and poses a risk of injury and death of animals and people.	Very Low (-)
Traffic		The change in the traffic patterns as a result of traffic entering and exiting the new mine, on the surrounding road infrastructure and existing traffic.	Low (-)
		Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, busses and other heavy vehicles.	Low (-)
Health and Safety		Possibility of mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to mine workers and surrounding landowners, visitors and workers.	Very Low (-)
		Increased risk to public health and safety: Dangerous areas and mining activities including blasting, pose health risks and	Very Low (-)

NATURE	DESCRIPTION OF IMPACT	SIGNIFICANCE POST-MITIGATION
	possible loss of life to mine workers and visitors to the site.	
	Security risks: Trespassing of mine workers on adjacent properties and possible crime.	Very Low (-)
	Spreading of diseases such as diarrhoea, HIV and TB.	Low (-)
Socio-economic	Skills development for historically disadvantaged individuals (HDI's) and others from the local communities in the North West Province. Individuals will be more employable after the operational phase, which will benefit themselves, the workforce, the community and the economy.	Medium (+)
	Development and upliftment of the surrounding communities and infrastructure.	Medium (+)
	Development of the economic environment, by job provision and sourcing supplies for and from local residents and businesses.	Medium (+)
	Creation of short to long term employment during all the phases of mining for local residents and skills transfer to unskilled and semi-skilled unemployed individuals.	Medium (+)
	Sourcing supplies from local residents and businesses.	Medium (+)

PREFERRED ALTERNATIVE (DECOMMISSIONING AND REHABILITATION PHASE)

NATURE	DESCRIPTION OF THE IMPACT	POST-MITIGATION
Geological and Soils	Loss of topsoil and soil erosion through vegetation clearance, wind and stormwater.	Very low (-)
	Soil compaction by heavy duty vehicles.	Low (-)
	Contamination of soils through: • Indiscriminate disposal of decommissioning waste; and • Accidental spillage of chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles and other chemicals from decommissioning activities.	Low (-)
Agricultural potential and land capability	Possibility of decommissioning and rehabilitation activities and workers causing veld fires destroying veld and animals on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)
	Restoring altered landforms due to excavation.	High (+)
Existing Land Use and Capability	Possibility of decommissioning and rehabilitation activities and workers causing veld fires destroying veld and animals on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)

NATURE		DESCRIPTION OF THE IMPACT	POST-MITIGATION
Hydrology	Surface water and Groundwater	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality during the decommissioning phase.	Very Low (-)
		Contamination of stormwater runoff and groundwater, caused by: • Spills and leaks of cement; • Sediment release; • Chemical toilets; • Chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles; • Indiscriminate storage and disposal of hazardous waste; • Other chemicals from construction activities e.g. paints; and • Effluent discharges, due to a lack of stormwater management.	Very Low (-)
		Altered drainage patterns and stormwater runoff flows.	Very Low (-)
		Impacts of dewatering on the groundwater aquifer should water be abstracted from groundwater during the decommissioning phase.	Low (-)
		Acid Mine Drainage.	Low (-)
Biodiversity	Flora and Fauna	Disturbance of fauna through noise, light and dust pollution and hunting, trapping and killing of fauna.	Very Low (-)
		Spreading of alien invasive species.	Low (-)
		Impact on natural migratory routes and faunal dispersal patterns.	Medium (-)
Archaeological/Heritage Resources		Potential for alteration of archaeological, historical and paleontological resources, should it be discovered during the decommissioning and rehabilitation phase.	Very Low (-)
Visual and Lighting		Visibility from sensitive receptors / visual scarring of the landscape as a result of the decommissioning and rehabilitation activities.	Medium (-)
		Visibility of solid domestic waste and building rubble.	Very Low (-)
		Impact of security lighting on surrounding landowners and animals.	Very Low (-)
Noise and Vibration		Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with heavy duty vehicles and equipment.	Very Low (-)
		Disturbance due to vibrations caused by construction vehicles.	Very Low (-)

NATURE	DESCRIPTION OF THE IMPACT	POST-MITIGATION
Air Quality	Increased dust pollution due to construction vehicles and decommissioning activities.	Very Low (-)
	Settling of dust on the surrounding area and pasture for livestock, may impact livestock.	Very Low (-)
	Windborne dust (soil), vehicle fumes and particulate matter of PM_{10} and smaller, altering air quality.	Very Low (-)
Waste (including hazardous materials)	Generation of additional general waste/ litter / building rubble and hazardous material during the decommissioning phase.	Low (-)
	Indiscriminate disposal of waste could pollute natural resources and ecosystems and pose a risk of injury and death of animals and people.	Very Low (-)
Services Water, Sewage, Electricity	Need for services i.e. water, electricity and sewerage systems during the decommissioning phase causing additional strain on natural resources.	Medium (-)
Traffic	The change in the traffic patterns as a result of traffic entering and exiting the proposed mine on the surrounding road infrastructure and existing traffic.	Low (-)
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, busses and other heavy vehicles.	Low (-)
Health and Safety	Possibility of when 'hot' work is done (e.g. welding) and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Very Low (-)
	Increased risk to public health and safety: Dangerous areas and decommissioning activities pose health risks and possible loss of life to construction workers and visitors to the site.	Very Low (-)
	Security risks: Trespassing of workers on adjacent properties and possible crime.	Very Low (-)
	Spreading of diseases such as diarrhoea, HIV and TB.	Low (-)
Socio-economic	Creation of short term employment opportunities for the local communities, during the decommissioning phase.	Medium (+)
	Sourcing supplies from local residents and businesses.	Medium (+)

NO-GO ALTERNATIVE

NATURE	DESCRIPTION OF THE IMPACT	POST-MITIGATION
Socio-economic	No skills development for historically disadvantaged individuals (HDI's) and others from the local communities in the Northwest Province. Individuals will be more employable after the operational phase, which will benefit themselves, the workforce, the community and the economy.	Medium (+)
	No development and upliftment of the surrounding communities and infrastructure.	Medium (+)
	No development of the economic environment, by job provision and sourcing supplies for and from local residents and businesses	Medium (+)
	No creation of short to long term employment during all the phases of mining for local residents and skills transfer to unskilled and semi-skilled unemployed individuals.	Medium (+)
	No negative impacts on the biophysical and socio-economic environment	Very High (+)

RECOMMENDATIONS

Based on the outcome of the impact assessment, our recommendation is that the application for the proposed development should continue, and that the Applicant be allowed to investigate the establishment of the proposed Elandsdrift Opencast Chrome Mine. This authorisation should be in line with sensitive planning, design and good environmental management. If the concept of sustainable development is considered, it is proposed that the mine will have a positive impact on the provision of social and economic criteria. With the recommended guidelines provided by the various specialists' studies; the ecological component can also be brought into balance. In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through physical measures, the recommendations from the EIA are included within the Environmental Management Programme (EMPr). It is also our recommendation that this EMPr is approved. It will ultimately be the proponent's responsibility to ensure that all involved parties comply with the EMPr and the conditions of the Environmental Authorisation (EA). If the concept of sustainable development is considered it is proposed that the chrome mine will have a positive impact on the provision of social and economic criteria. With the recommended guidelines which would be provided by the various specialists' studies; the ecological component can also be brought into balance.

CONCLUSION

A variety of mitigation measures have been identified that will serve to mitigate the scale, intensity, duration or significance of the potential negative impacts identified. These include guidelines to be applied during the construction, operational and decommissioning phases of the proposed project. The EMPr contains more detailed mitigation measures and is attached in ***Annexure 8*** of this report. The proposed mitigation measures, if implemented, will reduce the significance of the majority of the identified impacts. It is therefore the recommendation of ENVASS, based on the assessment of the current available information, that the Environmental Impact Report for the proposed Elandsdrift Opencast Chrome Mine be accepted by the Competent Authority (CA). The authorisation should be in line with sensitive planning, design and good environmental management. Though mining undoubtedly always has an impact on the environment it should be noted that the proposed mine will have some positive social and economic impact as it will allow for employment of individuals during the construction, operational and decommissioning phases, in the Mooinooi area which is an area where unemployment is rife.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ANNEXURES

	Originated By:	Reviewed By:	Approved By:
Name:	Monica Niehof	Retha Weir	Rachelle Stofberg
Designation:	Environmental Consultant	Quality Reviewer	Senior Operations Manager
Signature:			
Date:	2015/03/03	2015/03/06	2015/03/09

ABBREVIATIONS

ABI	Avifaunal Biodiversity Index
AIA	Archaeological Impact Assessment
ASPT	Average Score per Taxon
BID	Background Information Document
CA	Competent Authority
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs (formerly known as DWAF)
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation (formerly known as DWA)
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Program
ESA	Early Stone Age
FSR	Final Scoping Report
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IUCN	International Union for the Conservation of Nature
LIA	Late Iron Age
LSA	Late Stone Age
Mbgl	Meters below ground level
MHSA	Mine Health and Safety Act (Act No. 29 of 1996) [as amended]
MIA	Middle Iron Age
MSA	Middle Stone Age
MWP	Mining Works Program
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended]
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) [as amended]
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NSBA	National Spatial Biodiversity Assessment
NW DEDECT	North West Department of Economic Development, Environment, Conservation and Tourism
NWA	National Water Act, 1998 (Act No. 36 of 1998) [as amended]
PPP	Public Participation Process
RoM	Run of Mine
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SASS	South African Scoring System
SDF	Spatial Development Framework
WCM	Western Chrome Mines

GLOSSARY OF TERMS

Alien species: A plant or animal species introduced from elsewhere: neither endemic nor indigenous.

Applicant: Any person who applies for an authorisation to undertake an activity or undertake an Environmental Process in terms of the Environmental Impact Assessment Regulations – National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as contemplated in the scheduled activities listed in Government Notice (GN) No R. 543, 544 and 545.

Arable potential: Land with soil, slope and climate components where the production of cultivated crops is economical and practical.

Archaeological resources: This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which South African Heritage Resources Agency (SAHRA) considers to be worthy of conservation; features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cultural significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Cumulative impact: In relation to an activity, cumulative impact means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

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

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

Environmental impact assessment: In relation to an application, to which Scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application.

Environmental impact report (EIR): In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental management programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.

Gangue: Commercially valueless material in which ore is found.

Heritage resources: This means any place or object of cultural significance. See also archaeological resources above.

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

NO_x: A generic term for mono-nitrogen oxides (NO) and (NO_2 (nitric oxide and nitrogen dioxide).

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Red data species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature (IUCN) and Natural Resources.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

1. BACKGROUND

Environmental Assurance (Pty) Ltd [herein after referred to as ENVASS], as independent environmental consultant, has been appointed by the Applicant, Samancor Chrome Limited Western Chrome Mine [herein after referred to as the Applicant], to undertake all the authorisations required for the development of the proposed Elandsdrift Opencast Chrome Mine and associated infrastructure on Portions 63, 64, 65, 69, 111 and 140 of the farm Elandsdrift 467 JQ. The study area is located within the boundaries of the Bojanala District and Madibeng Local municipalities of the North West Province.

The proposed chrome mine together with its associated infrastructure and activities requires the following authorisations:

- Environmental Authorisation (EA) from the Competent Authority (CA) regulating environmental aspects, the North West Department of Economic Development, Environment and Tourism (NW DEDECT);
- Mining right from the CA regulating mining aspects, the Department of Mineral Resources (DMR); and
- Water Use License (WUL) from the CA regulating water use aspects, the Department of Water and Sanitation (DWS).

It was against this backdrop that ENVASS was appointed to ensure that the development will be carried out in accordance with the Environmental Impact Assessment (EIA) Regulations (as amended) which were promulgated in June 2010 under the National Environmental Management Act (no. 107 of 1998 [as amended] (NEMA). All relevant legislation has been consulted during the Scoping and EIA process and will be complied with at all times.

The North West Department of Economic Development, Environment, Conservation and Tourism (NW DEDECT), on 20 August 2014, accepted the Scoping Report which ENVASS undertook and NW DEDECT accordingly advised the Environmental Assessment Practitioner (EAP) [ENVASS] in terms of Regulation 31 (1) (a) of the NEMA EIA Regulations to proceed with the steps as contemplated in the Plan of Study (PoS) for EIA, including the public participation process for EIA referred to in Regulation 28 (h) (i – iv) and prepare the EIA report in respect of the proposed activity.

2. INTRODUCTION

This section presents the CA with the details of the Applicant applying for authorisation as well as the details of the Environmental Assessment Practitioner (EAP) who compiled this Final EIA and the expertise of ENVASS which enables them to carry out EIAs.

2.1 Details of Applicant and mine

Table 1: Applicant and mine details

NAME OF APPLICANT	Samancor Chrome Limited Western Chrome Mines
NAME OF MINE	Elandsdrift Opencast Chrome Mine
CONTACT PERSON	Mr William Smart
POSTAL ADDRESS	PO Box 245 Mooinooi 0325
PHYSICAL ADDRESS	Portions 63, 64, 65, 69, 111 and 140 of the farm Elandsfrift 467 JQ which are located 25 km west of Brits and 33 km east of Rustenburg
TELEPHONE NUMBER	014 574 6000 (6061)
FAX NUMBER	014 574 6193
CELL PHONE NUMBER	073 352 2256
EMAIL	William.Smart@SamancorCr.com
LOCATION OF MINE	Portions 63, 64, 65, 69, 111 and 140 of the Farm Elandsfrift 467 JQ.
MINERAL TYPE	Chrome ore (Cr) commodity Code B (Chromite)
ESTIMATED LIFE OF MINE	Based on a production rate of 50,000 tons of Run of Mine (RoM) ore per month, the life of mine for the opencast will vary between approximately 31 months (MG1 only) to almost 12 years (for the MG1-MG2-MG3-MG4 combination). Hence the maximum period of 30 years is requested for this application, as per the Mining Works Program (MWP).
EXTENT OF THE AREA REQUIRED FOR MINING	Approximately 180 ha
EXTENT OF THE AREA REQUIRED FOR INFRASTRUCTURE, ROAD, SERVITUDES, ETC.	Approximately 10 ha
DEPTH OF THE MINERAL BELOW SURFACE	From sub outcrop, 1 m below the surface, to an excess of 30 to 60 m below surface

2.2 Details and expertise of the Environmental Assessment Practitioner [Regulation 31 (2) (a) (i - ii)]

Table 2: Details and expertise of the Environmental Assessment Practitioner

NAME OF ENVIRONMENTAL CONSULTANCY	Environmental Assurance (Pty) Ltd [ENVASS]
REGISTRATION NO. OF APPLICANT	2004/02655/07
PROJECT TEAM	ENVASS TEAM • Emile van Druten (Specialist, Pri. Sci. Nat) [BSc Hons Environmental Management] • Rachelle Stofberg (Senior Environmental Consultant) [B.Sc. Cons. Ecol. / M Env. Man.]; • Monica Niehof (Environmental Consultant) [B.Sc. Hons. Env. Man.]; • Vuyokazi April (Ecological Specialist, Pri. Sci. Nat) [M.Sc. Entomology]; and • Du Toit Wilken (Visual, Noise and Air Quality Specialist) [M.Sc. Env. Sci.].
EXPERTISE OF EAP	ENVASS has the necessary experience within our project team to carry out Scoping and EIA processes. Auditing, WULA, MPRDA and EIA (NEMA) projects have been completed for various mining companies throughout South Africa: • Samancor Chrome; • Amari Resources; • South African Coal Mine Holdings Limited; • Canyon Coal; • Eastplats; • Makoya Supply Chain Holdings; • Coal of Africa; • Assmang BRMO; and • Shanduka Coal.
ENVIRONMENTAL CONSULTANT	Monica Niehof
PHYSICAL AND POSTAL ADDRESS	394 Tram Street Brooklyn Pretoria 0181
TELEPHONE NUMBER	012 460 9768
FAX NUMBER	012 460 3071
EMAIL	monica@envass.co.za

2.3 Details of the specialist project team

Table 3: Details of specialist team

ORGANISATION	SPECIALIST INFORMATION / STUDY
Galago Environmental	Ecological
Geo Pollution Technologies	Geohydrological
Environmental Assurance	Bio monitoring
Corli Havenga Transportation Engineers	Traffic
M² Environmental Connections	Service water
Archaetnos Culture and Cultural Resource Consultants	Heritage
EcoSoil	Soil and land capability assessment
Environmental Assurance	Social Impact Assessment

3. LOCATION OF THE ACTIVITY [REGULATION 31 (2) (c) (i-ii)]

The Elandsdrift Opencast Mine is situated on Portions 63, 64, 65, 69, 111 and 140 of Farm Elandsdrift 467JQ, North West Province and within the jurisdiction of the Madibeng Local Municipality. The proposed site is 34 km East of Rustenburg along the R27 road; the nearest neighbouring town is Mooinooi, approximately 2,1km away. The mineral to be mined is chromite and in particular the Middle Group 1, and Middle Group 2 (MG1 and MG2) chromitite seams. The Elandsdrift Opencast Chrome Mine's coordinates are presented in Table 4.

Table 4: Coordinates

LOCATION	COORDINATE
East	25°43'44.87"S 27°33'21.89"E
South	25°44'0.22"S 27°32'11.83"E
North	25°43'49.44"S 27°32'7.24"E
West	25°44'9.23"S 27°30'45.21"E
Centre	25°43'59.31"S 27°32'5.30"E

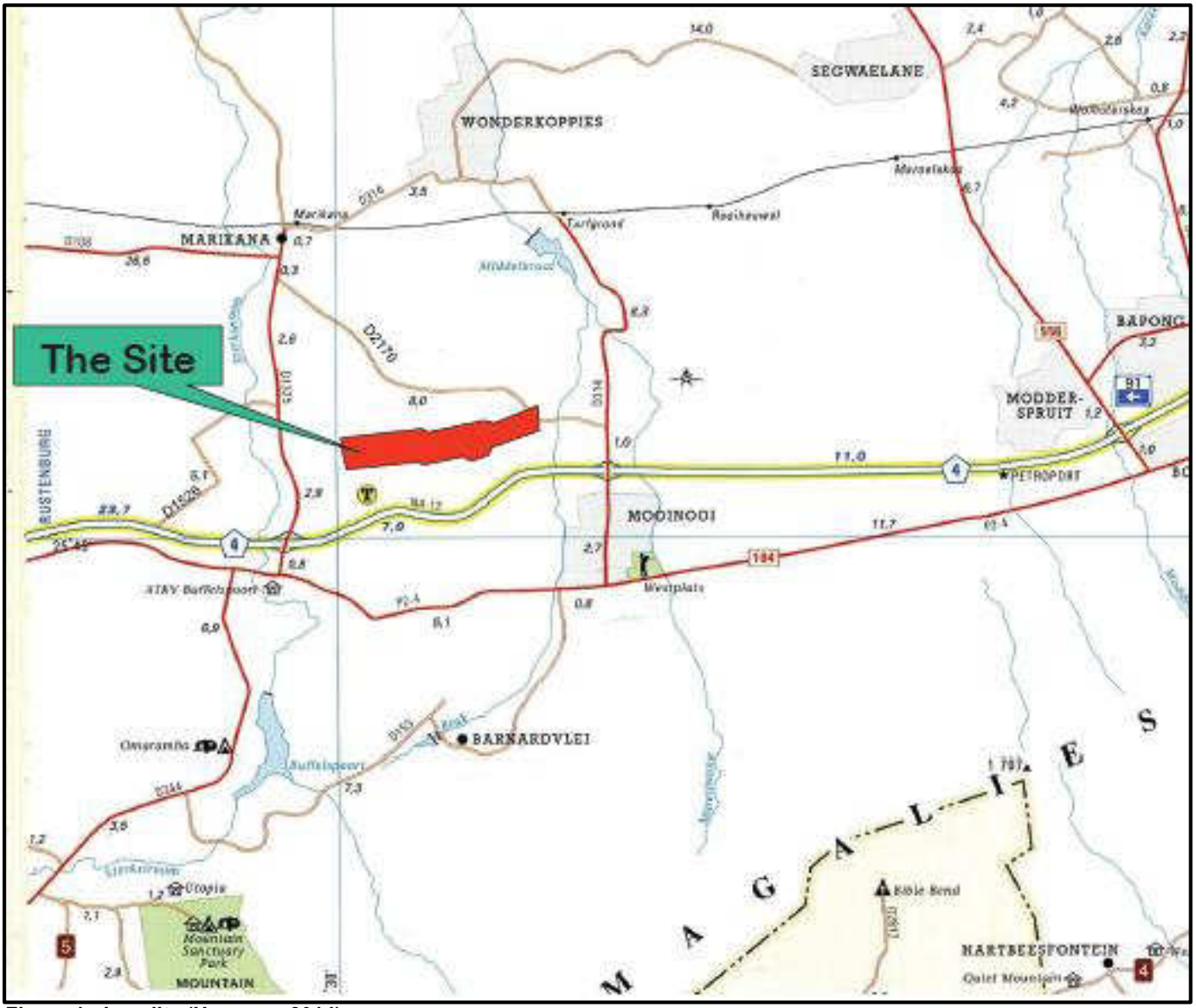


Figure 1: Locality (Havenga, 2014)

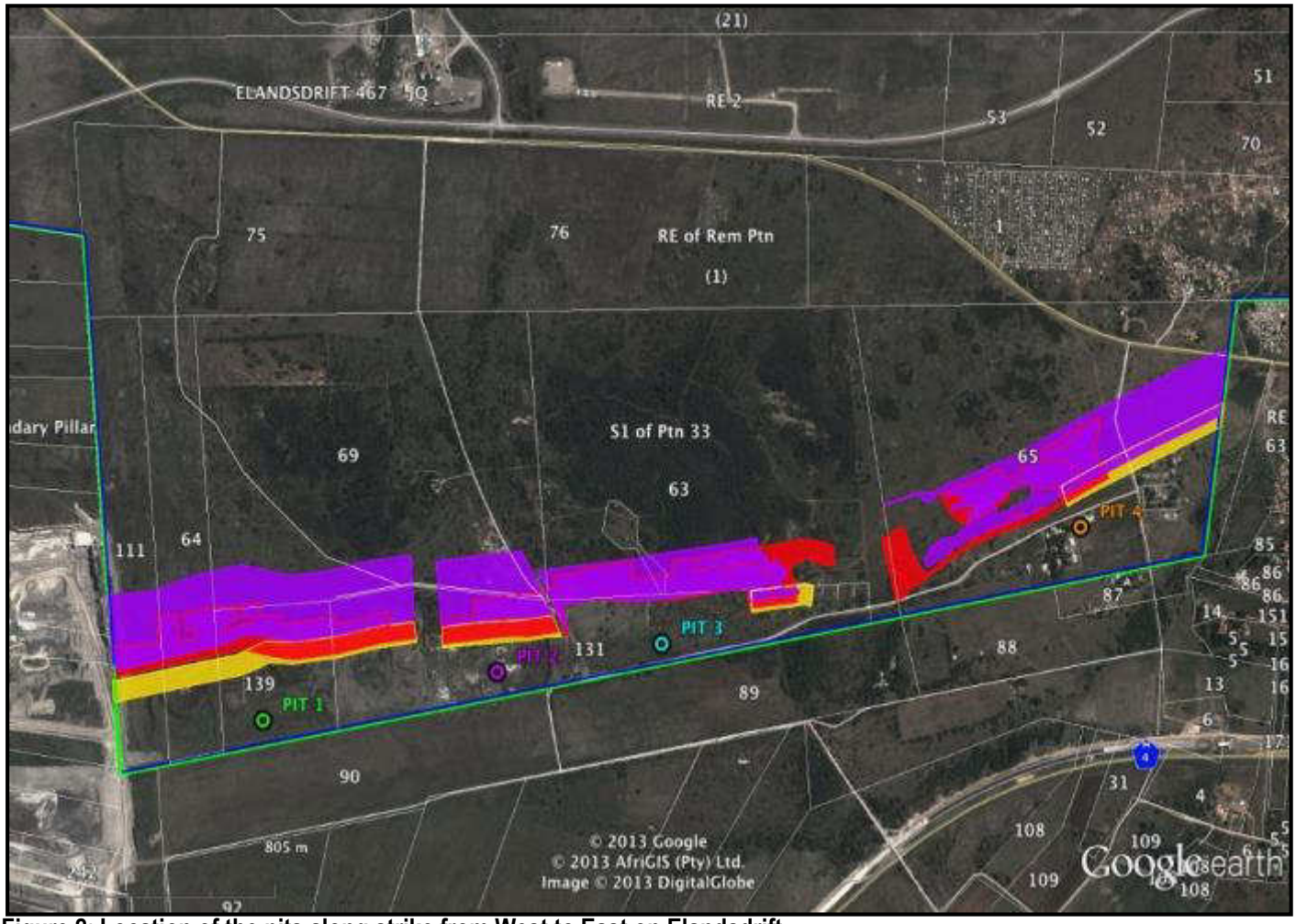


Figure 2: **Location of the pits along strike from West to East on Elandsdrift**

Table 5: Colour Legend of map in Figure 2

Description	Colour
Proposed MG0 Mining area	Yellow
Proposed MG1 Mining Area	Red
Proposed MG2, MG3 and MG4 Mining Area	Purple

4. NEED AND DESIRABILITY [REGULATION 31 (2) (f)]

According to the Western Cape Department of Environmental Affairs and Development Planning's (WC DEADP) Guideline on Need and Desirability: EIA Guideline and Information Document Series (2011), to describe the need for a development, it must be determined whether it is the right *time* for locating the type of land use and/or activity being proposed. To describe the desirability for a development, it must be determined, whether it is the right *place* for locating the type of land use and/or activity being proposed. Need and desirability can be equated to the concept of *wise use of land which can be determined through* the question of what is the most sustainable use of land. In light of the above, the need and desirability of an application must be addressed separately and in detail answering *inter alia* the following questions:

Table 6: Need and desirability considerations

A) NEED (TIMING)		
QUESTION A1: Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority?		The project is aligned with the objectives of the Spatial Development Framework (SDF) and Integrated Development Plan (IDP) and will not compromise the integrity of these respective forward planning documents.
YES	NO	
QUESTION A2: Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?		Most market commentators deal with the ferrochrome market, rather than chrome ore specifically. Chromite has several industrial end uses, primarily based on its Cr:Fe ratio. High chromium ores (defined by having high Cr:Fe ratios) are used for producing ferro-chromium for metallurgical applications such as stainless steel (the most important application by volume, ca. 85%) and special uses (super alloys, special steels and plating). High iron chromitites are being used for the production of low-quality ferrochromium, foundry sands, chromium salts (used in the leather tanning industry, as a pigment and in chromium plating) and refractory purposes (production of magnesite chromite and chromite-magnesite bricks). Thin coatings of chromium alloys are used as platings on automotive parts, appliances and other products and given the name "chrome plated". There are no economical substitutes for chromite ore in the production of ferrochrome (i.e. stainless steel), chromium chemicals, super alloys or chromite refractories at present. Currently, chromium-free substitutes either compromise product quality and/or increase costs. Chrome Ore Supply/Demand: Up to mid-2008, supply of world chromite was under severe pressure driven by the robust demand for ferrochrome used in ferroalloy production. Over 90% of the world's chromite production is converted into ferrochrome for metallurgical applications. Given that most chromite is produced by vertically integrated ferrochrome producers, the amount of material available to non-metallurgical markets has been in short supply. This has changed somewhat since 2008 and global chrome prices have fallen drastically (McQuade, 2013). One of the main challenges for purchasers of non-metallurgical chromite is that consumers do not have a huge choice when it comes to supply. Production is concentrated in just a few countries, notably South Africa which produces about 50% of the world's chromite, followed by India and Kazakhstan with about 20% and 15%, respectively. As a result of the global crisis in late 2008, the demand for steel plummeted, forcing most of the ferrochrome producers to place their operations on care and maintenance. This situation lasted through most of 2009 and it was only in late 2009 that ferrochrome producers began to slowly restart their furnaces. Demand for ferrochrome used in making ferroalloy, which in turn is used in making stainless steel, has led to a severe shortage of chromite. Non-metallurgical applications consume only a fraction of chromite production, with the refractory industry accounting for only about 1% and 3% each for the foundry and chemical industries. The non-metallurgical industry is dependent on chromite requirements of the metallurgical industry as most chromite is manufactured by vertically integrated ferrochrome producers. Major traders of non-metallurgical chromite from South Africa provide more than half of global chromite supply. The declining availability of chromite is becoming problematical, especially when non-metallurgical applications are indicating increased demand for the material. The supply shortage is mainly attributed
YES	NO	

		to the booming stainless steel industry. Prices have also soared, with non-metallurgical chromite consumers compelled to match metal prices to ensure supply. Demand for chromite, and ferrochrome, is expected to remain strong mainly due to the continued growth of China's stainless steel industry. Until more supply comes onto the market, consumers of non-metallurgical chromite can expect continuing tightness in supply (McQuade, 2013). Chromite ore is graded by its chromic oxide (Cr_2O_3) content, and its price is reported in trade journals on a gross-weight basis (US Dollars per metric ton, gross weight). Commercially traded chromite ore grades range from 35% to 55% Cr_2O_3. The products at Samancor Chrome's Western Chrome Mines are essentially determined based on size and chrome content. Typical specifications for the different products are the following: • Chemical grades. With a minimum chromite content of 45.5%, silica content of less than 1.0%, and magnesium oxide content of less than 9.8%, manufacturers of chrome-based chemicals find these grades attractive raw materials for their processes; • Metallurgical grades. Concentrates have Cr:Fe ratios of between 1.5 – 1.6, a silica content of less than 3.0%, and phosphorus and sulphur contents below 50; and • 20ppm respectively. These products are well-suited to producers of charge chrome (McQuade, 2013). Approximately 65% of the products from Western Chrome Mines are for the domestic market, having been trucked from the beneficiation operations with the main customers being the following: • Ferrometals, IC3, located in Witbank, Mpumalanga Province; • Tubatse Ferrochrome Steelpoort, Limpopo Province; and • Middelburg Ferrochrome and Middelburg Technochrome, located in Middelburg, Mpumalanga Province (McQuade, 2013). The remaining products are exported internationally through the Durban and Richards Bay terminals. The export product is trucked to the Turfgrond siding, where it is loaded onto rail trucks for railing down to Richards Bay Port (McQuade, 2013). It is important that this development occurs at this period of time to address the current demands for chrome.
QUESTION A3: Does the community/area need the activity and the associated land use concerned (is it a societal priority)?		Both the Local and District Municipalities have a very poor employment and income profile with the illiteracy level being low in the Local Municipality but increases in the District Municipality. The Elandsdrift Opencast Chrome Mine will have a significant positive impact on the baseline socio-economic conditions of the local communities involved. The mine will create several employment opportunities and preference will be given to the locally unemployed, wherever possible. The mine will furthermore contribute towards the socio-economic development of the region as a whole through social upliftment and job creation as primary agents.
YES	NO	

QUESTION A4: Are the necessary services with the adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?		Infrastructure will have to be constructed for the mining operations.
YES	**NO**	
QUESTION A5: Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)?		No municipal infrastructure will be required for the study area.
YES	**NO**	
QUESTION A6: Is this project part of a national programme to address an issue of national concern or importance?		The project is not part of a national program.
YES	**NO**	
B) DESIRABLILITY (PLACING)		
QUESTION B1: Is the development the best practicable environmental option for this land/site?		There is a large portion of the study area that is already disturbed by previous mining activity, spoils dumps and built up areas. The majority of the area has very shallow rocky soils with rocky outcrops and has a class 8 land capability, and is therefore an area with little agricultural potential.
YES	NO	
QUESTION B2: Would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF as agreed to by the relevant authorities?		The project is aligned with the objectives of the municipal SDF and IDP and will not compromise the integrity of these respective forward planning documents.
YES	**NO**	
QUESTION B3: Would the approval of this application compromise the integrity of the existing environmental management priorities of the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?		The project is aligned with the objectives of the EMF and will not compromise the integrity of these respective forward planning document.
YES	**NO**	
QUESTION B4: Do location factors favour this land use (associated with the activity applied for) at this place, etc.)?		Since the chrome is contained in an underlying belt in the development area, no location alternatives are applicable to this project. Locating the development in another area will result in the ore not being utilised and the economy and society will not be benefiting from the Elandsdrift Opencast Chrome Mine.
YES	NO	

<table>
<tr><td colspan="2">QUESTION B5: Will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?</td><td rowspan="2">There is a large portion of the study area that is already disturbed with previous mining activity, spoils dumps and built up areas. However the following sensitive areas were identified and can be impacted on:
• Because of its pristine nature and high species diversity, the Combretum – Berchemia outcrop study unit should be considered sensitive and mining activities might impact on the study unit;
• The Marula trees on the north-western quadrant of the site should be preserved in situ. A suitably qualified person should identify and mark the trees to facilitate preservation. A suitable buffer that will ensure persistence of the trees should be allowed around each Marula tree.
• Considering the scale of the proposed mining activities, the loss/displacement of some fauna is a foregone conclusion, particularly that of terrestrial species, but in the overall picture of the affected species, it will be minimal. However, maintaining (and even improving) the conservation integrity of the Elandsdriftspruit is imperative and non-negotiable. This water source should be regarded as sensitive, as such providing indispensable habitat for Red Listed and sensitive species as well as serving in places as a dispersal corridor. This implies a buffer zone of 100 metres from the edge of the riparian zone (as prescribed for areas outside the urban edge) for the Elandsdriftspruit. However, maintaining (and even improving) the conservation integrity of the Elandsdriftspruit is imperative and non-negotiable; and
• During the survey one site of cultural heritage significance was located in the area to be developed. It is a grave yard belonging to the Historical Age.</td></tr>
<tr><td>YES</td><td>NO</td></tr>
<tr><td colspan="2">QUESTION B6: Will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?</td><td rowspan="2">Noise, dust and odours will increase, however with the proper mitigation measures and good practice environmental management measures, it will result in minimal impacts. The construction and operation of the Samancor Elandsdrift mine related activities and its associated infrastructure will have a visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact can be reduce to a point where the visual impact can be regarded as insignificant.</td></tr>
<tr><td>YES</td><td>NO</td></tr>
<tr><td colspan="2">QUESTION B7: Will the proposed land use result in unacceptable cumulative impacts?</td><td rowspan="2">As already mentioned, through the implementation of good practice environmental management measures, all direct and cumulative impacts which may result from the proposed development will be addressed and ensure that the environment is affected to the minimum.</td></tr>
<tr><td>YES</td><td>NO</td></tr>
</table>

5. LEGISLATIVE FRAMEWORK

5.1 National legislative framework

This section provides an overview of the legislative requirements applicable to this project and it includes the acts, guidelines and policies considered in the compilation of this report.

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

The legislative motivation for this project is underpinned by the Constitution of South Africa, 1996 (Act No. 108 of 1996), which states: "The State must, in compliance with Section 7(2) of the Constitution, respect, protect, promote and fulfil the rights enshrined in the Bill of Rights, which is the cornerstone of democracy in South Africa".

Section 24 of the Constitution states:

"Everyone has the right-

(a) To an environment that is not harmful to their health or well-being; and

(b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-

(i) Prevent pollution and ecological degradation;

(ii) Promote conservation; and

(iii) Secure ecologically sustainable development and use of natural resources while promoting a justifiable economic and social development".

Section 24 of the Constitution requires that all activities that may significantly affect the environment and require authorisation by law must be assessed prior to approval. In addition, it provides for the Minister of Environmental Affairs or the relevant provincial Ministers to identify:

- New activities that require approval;
- Areas within which activities require approval; and
- Existing activities that should be assessed and reported on.

Section 28 (1) of the Constitution states that: *"every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring".* If such pollution or degradation cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution or degradation.

These measures may include:

- Assessing the impact on the environment;
- Informing and educating employees about the environmental risks of their work and ways of minimising these risks;
- Ceasing, modifying or controlling actions which cause pollution/degradation;
- Containing pollutants or preventing movement of pollutants;
- Eliminating the source of pollution or degradation; and
- Remedying the effects of the pollution or degradation.

5.1.2 National Environmental Management Act (no. 107 of 1998) [as amended] and Environmental Impact Assessment Regulations (2010) [as amended]:

The Applicant is applying for an EA in terms of the National Environmental Management Act (no. 107 of 1998) (as amended) [NEMA] and the Environmental Impact Assessment (EIA) Regulations of 2010 (Government Notice No's R 543, 544 and 545 in Government Gazette No. 33306 of 18 June 2010) [as amended] for the construction and operation of an opencast chrome mine. NEMA strives to regulate national environmental management policy and is focussed primarily on co-operative governance, public participation and sustainable development. NEMA makes provisions for co-operative environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by Organs of State and to provide for matters connected therewith.

The proposed construction and operational activities associated with the chrome mine falls within the ambit of the scheduled activities listed in Government Notice (GN) No. 544 and 545 (Table 7). A full Scoping and EIA process is being undertaken in terms of the requirements stipulated in GN. No. 543.

Regulation 31 deals with the EIA Report (EIAR) and depicts the contents of an EIA:

31 (2) An EIAR must contain all information that is necessary for the CA to consider the application and to reach a decision contemplated in Regulation 35 and must include:

- *(a) Details of*
  - *(i) The EAP who compiled the report; and*
  - *(ii) The expertise of the EAP to carry out an EIA;*
- *(b) A detailed description of the proposed activity;*
- *(c) A description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is*
  - *(i) A linear activity, a description of the route of the activity; or*
  - *(ii) An ocean-based activity, the coordinates where the activity is to be undertaken;*
- *(d) A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;*
- *(e) Details of the Public Participation Process (PPP) conducted in terms of Sub regulation (1), including*
  - *(i) Steps undertaken in accordance with the PoS;*
  - *(ii) A list of persons, organisations and organs of state that were registered as Interested and/or Affected Parties (I&APs);*
  - *(iii) A summary of comments received from, and a summary of issues raised by registered I&APs, the date of receipt of these comments and the response of the EAP to those comments;*
  - *(iv) Copies of any representations and comments received from registered I&APs;*
- *(f) A description of the need and desirability of the proposed activity;*
- *(g) A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;*
- *(h) An indication of the methodology used in determining the significance of potential environmental impacts;*
- *(i) A description and comparative assessment of all alternatives identified during the EIA process;*
- *(j) A summary of the findings and recommendations of any specialist report or report on a specialised process;*
- *(k) A description of all environmental issues that were identified during the EIA process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;*
  - *(l) An assessment of each identified potentially significant impact, including*
  - *(i) Cumulative impacts;*
  - *(ii) The nature of the impact;*
  - *(iii) The extent and duration of the impact;*
  - *(iv) The probability of the impact occurring*
  - *(v) The degree to which the impact can be reversed;*
  - *(vi) The degree to which the impact may cause irreplaceable loss of resources;*
  - *(vii) The degree to which the impact can be mitigated;*
- *(m) A description of any assumptions, uncertainties and gaps in knowledge;*
- *(n) A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of the authorisation;*
- *(o) An environmental impact statement which contains*
  - *(i) A summary of the key findings of the EIA; and*
  - *(ii) A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;*
- *(p) A draft Environmental Management Program (EMPr) containing the aspects contemplated in Regulation 33;*
- *(q) Copies of any specialist reports and reports on specialised processes complying with Regulation 32;*
- *(r) Any specific information that may be required by the CA; and*
- *(s) Any other matters required in terms of Sections 24 (4) (a) and (b) of NEMA*

(3) The EAP managing the application must provide the CA with detailed, written proof of an investigation as required by Section 24 (4) (b) (i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in Sub regulation 31 (2) (g), exist.

Regulation 32 deals with specialist reports as well as reports on specialised processes and depicts the contents of these reports:

32 (1) An Applicant or the EAP managing an application may appoint a person to carry out a specialist study or specialised processes.

(2) The person referred to in Sub regulation (1) must comply with the requirements or regulation 17;

(3) A specialist report or a report on specialised processes prepared in terms of the Regulations must contain

(a) Details of

(i) The person who prepared the report;

(ii) The expertise of that person to carry out the specialist study or specialised process;

(b) A declaration that the person is independent in a form as may be specified by the CA;

(c) An indication of the scope of, and the purpose for which, the report was prepared;

(d) A description of the methodology adopted in preparing the report or carrying out the specialised processes;

(e) A description of any assumptions made and any uncertainties or gaps in knowledge;

(f) A description in findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;

(g) Recommendations in respect of any mitigation measures that should be considered by the Applicant and the CA;

(h) A description of any consultation process that was undertaken during the course of carrying out the study;

(i) A summary and copies of any comments that were received during any consultation process; and

(j) Any other information requested by the CA.

The proposed development triggers the following listed activities as set out in the EIA Regulations of 2010:

Table 7: Listed activities associated with the proposed mine

NOTICE	ACTIVITY	ACTIVITY DESCRIPTION	PROJECT RELEVANCE
544	9	The construction of facilities or infrastructure exceeding 1 000 metres in length for the bulk transportation of water, sewage or storm water - i) With an internal diameter of 0.36 metres or more; or ii) With a peak throughput of 120 litres per second or more, excluding where: a) Such facilities or infrastructure are for bulk transportation of water, sewage or stormwater or storm water drainage inside a road reserve; or b) Where such construction will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of a watercourse.	Bulk water supply infrastructure exceeding 1000 metres in length is required for the mining operations and will be constructed.
544	13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.	The construction of facilities or infrastructure for the storage and handling of dangerous goods (i.e. fuel and diesel) with a combined capacity of 80 but not exceeding 500 cubic metres.
544	22	The construction of a road outside urban areas - With a road reserve wider than 13,5 meters; Where no reserve exists where the road is wider than 8 meters; or	Roads (outside an urban area), wider than 8m maybe be constructed.

		For which an environmental authorization was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.	
545	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: i) Linear development activities; or ii) Agriculture or afforestation.	More than 20 hectares of land will be transformed by the construction of the mine and associated mining activities.
545	20	Any activity which requires a mining right or renewal thereof as contemplated in section 22 of the Mining and Petroleum Resources Development Act, 2002 (Act 28 of 2002).	The proposed mine and associated operations requires a mining right in terms of the Mineral and Petroleum Resources Development Act, 2002.

5.1.3 Mineral and Petroleum Resources Development Act (no. 28 of 2002) [as amended]

The proposed chrome mining operations requires authorisation from the Department of Mineral Resources (DMR). The principles of the Mineral and Petroleum Resources Development Act (no. 28 of 2002) (as amended)[MPRDA] is based on sustainable development by integrating social, economic, and environmental factors into the planning and implementation of mining projects, in order to ensure that exploitation of mineral resources serves present and future generations. Special consideration must be given to the EMPr to be and this must include fulfilment of the requirements of Regulation 51 of the MPRDA.

A Prospecting Right and subsequent Mining Right application was lodged at the DMR respectively in terms of Sections 16 and 22 of the MPRDA and the required Scoping and EIA was undertaken in accordance with the requirements of the MPRDA. The properties that relate to Samancor: Western Chrome Mines Mining Right Area as contained in mining authorization ML 21/1994 is presented in Table 8.

Table 8: Samancor Mining Right Areas

Operation	Farm	Portion	Mineral	Mineral Right Holder
Samancor: WCM	Elandsdrift 467 JQ	63, 64, 65, 69, 111, 140, (formerly S1 of 33)	Chromite	Samancor Ltd
Mooinooi	Elandsdrift 469 JQ	RE21, RE2, RE1, 34, 100, 111, 64, 63, 69, 140, 65		
	Elandskraal 469 JQ	78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 121, RE1, RE2		
	Middelkraal 466 JQ	52, 70, RE2, RE41		Samancor/Lonmin lease agreement
	Middelkraal 466 JQ	42		Samancor Ltd
	Buffelsfontein 465 JQ	25, 13, RE10		

5.1.4 National Water Act, 1998 (no.36 of 1998) [as amended]

The National Water Act (no. 36 of 1998) (as amended) [NWA] aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level.

The purpose of NWA is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways, which take into account:

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

The construction and operational activities associated with the proposed chrome mine requires compliance with the requirements of NWA as listed under GN No. 19182. An application for a Water Use License (WUL) will be lodged with the Hartebeespoortdam Regional Office of the Department of Water and Sanitation (DWS) in terms of Section 21 of the NWA to undertake the following activities:

a) Taking water from a water resource;
b) Storing of water;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

5.1.5 National Heritage Resources Act (no. 25 of 1999)

The proposed chrome mine must comply with the requirements stipulated in the National Heritage Resources Act, 1999 (Act 25 of 1998) (NHRA). NHRA legislates the necessity for Cultural and Heritage Impact Assessment (HIA) in areas earmarked for development, which exceed 0.5 ha or linear development exceeding 300 metres in length. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

Section 38 (1) of NHRA, subject to the provisions of subsections (7), (8) and (9), requires that any person who intends to undertake a development categorised as:

(a) The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
(b) The construction of a bridge or similar structure exceeding 50m in length;
(c) Any development or other activity which will change the character of a site-
  (i) Exceeding 5 000 m^2 in extent; or
  (ii) Involving three or more existing erven or subdivisions thereof; or
  (iii) Involving three or more erven or divisions thereof which have been consolidated within the past five years; or
  (iv) The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
(d) The re-zoning of a site exceeding 10 000 m^2 in extent; or
(e) Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Archaeological impact assessments (AIAs) are often commissioned as part of the heritage component of an EIA and are required under Section 38(1) of the NHRA of 1999, Section 38(8) of the NEMA and the MPRDA. A Phase 1 assessment has been

undertaken for the proposed project in accordance with Section 38 (1) (a). (Refer to Section 6.2.6 of this report for a summary of the report).

5.1.6 National Environmental Management: Biodiversity Act (no. 10 of 2004) [as amended]

The overarching aim of the National Environmental Management: Biodiversity Act (no. 10 of 2004) [NEMBA], within the framework of NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa as well as for the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

As part of its implementation strategy of NEMBA, the National Spatial Biodiversity Assessment (NSBA) was developed. This assessment classifies areas as worthy of protection based on its biophysical characteristics, which are ranked according to priority levels. The approach used for biodiversity planning is systematic and entails the following three key principles:

- The need to conserve a representative sample of biodiversity pattern, such as species and habitats (the principle of representation);
- The need to conserve the ecological and evolutionary processes that allow biodiversity to persist over time (the principle of persistence); and
- The need to set quantitative biodiversity targets that quantifies the degree of conservation required for each biodiversity feature in order to maintain functioning landscapes and seascapes.

Furthermore, the South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (*inter alia*) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems. NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 8 of the Act. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established. It is also appropriate to undertake an Ecological (Fauna and Flora) Impact Assessment for developments in an area that is considered ecologically sensitive and which requires environmental authorisation in terms of NEMA, with such assessment taking place during the Scoping or EIA phase. The Applicant is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity and to obtain permits if required.

5.1.7 Alien and Invasive Species Regulations (Government Notice 598 of 2014) and the Alien and Invasive Species List, 2014 in terms of NEMBA (Government Notice 599 of 2014)

The notices provides lists of alien and invasive species that the applicant is exempted from obtaining a permit for, a national list of invasive species and a list of prohibited species. It is the responsibility of the Applicant to ensure that all prohibited plant and animal species are eradicated as far as possible.

- *Notice 2 - Exempted Alien Species in terms of Section 66 (1) of NEMBA;*
- *Notice 3 - National Lists of Invasive Species in terms of Section 70(1) – List 1, 3-9 & 11 of NEMBA; and*
- *Notice 4 - Prohibited Alien Species in terms of Section 67 (1) – List 1, 3-7, 9-10 & 12.*

5.1.8 National Environmental Management: Air Quality Act (no. 39 of 2004) [as amended]

Section 28 (1) of NEMA places a general duty of care on any person who causes pollution, to take reasonable measures to prevent such pollution from occurring. The objective of the National Environmental Management: Air Quality Act, 2004 (NEM:AQA) is to regulate air quality in order to protect, restore and enhance the quality of air in the Republic, taking into account the need for

sustainable development. Furthermore, the provision of national norms and standards regulating air quality monitoring, management and the control by all spheres of government determine that specific air quality measures should be adhered to. Dust created during the construction and operational phases of the proposed chrome mine could influence air quality and thus make this legislation relevant to this development. Air quality monitoring during the operational phase of the mine will be considered to be a measure to exercise this duty of care, since it will establish the types and volumes of dust emissions emanating from the operational activities.

5.1.9 National Dust Control Regulations, 2013 (Government Notice 827 of 2013)

The Dust Control Regulations provides in its Section 6 measures for dust control. Dust created by the proposed activities during all phases of the development, which may affect employees and surrounding landowners may need to be controlled according to the regulations. The applicant will comply with these regulations and the measures are included in the EMP attached in ***Annexure 8*** of this report.

5.1.10 Conservation of Agricultural Resources Act (no. 43 of 1983)

The aim of the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA) is to provide for control over the utilisation of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources.

The soils occurring on the study area will be disturbed in the construction phase. Any medium to long-term impacts after construction needs to be limited. A land capability assessment has been undertaken to identify the present soil forms as well as their physical and chemical characteristics and how they will react to any disturbance. (Refer to Section 6.1.3 for a summary of the report).

5.1.11 National Environmental Management: Waste Act (no. 59 of 2008) [as amended]

The objectives of the National Environmental Management: Waste Act (no. 59 of 2008) [NEMWA] (as amended), and Waste Classification and Management Regulations, 2003 (GNR: 634 – 635) (as amended) are: To reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith. The construction and operational activities associated with the proposed chrome mine must be in accordance with the requirements of (NEMWA) and the Waste Classification and Management Regulations, 2003 (GNR: 634 – 635). On 02 June 2014, the National Environmental Management: Waste Amendment Act (No. 26 of 2014) [NEMWAA] came into effect. The regulation and management of mine residue stockpiles and tailings facilities are now regulated under NEMWAA. Reference is made to the Schedule 3 (Defined Wastes) definitions of NEMWAA:

Hazardous waste is waste that contains organic or inorganic elements or compound that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environmental and includes hazardous substances, materials or object within business waste, residue deposits and residue stockpiles. Residue deposits are residue stockpiles remaining at the termination, cancellation or expiry of a prospecting right, mining permit, mining right, exploration right or production right. Residue Stockpiles are any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining operation and which is stockpiled, stored or accumulated within the mining area for a potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an older order right, including historic mines and dumps created prior to the implementation of the NEMWAA.

Residue deposits and residue stockpiles include:

- Wastes resulting from exploration, mining, quarrying as well as physical and chemical treatment of minerals:
  - Wastes from mineral excavation;
  - Wastes from physical and chemical processing of metalliferous minerals;
  - Wastes from physical and chemical processing of non-metalliferous minerals; and
  - Wastes from drilling muds and other drilling operations.

Currently no transitional arrangements are in place and the EAP is currently in consultation with the Department of Environmental Affairs and the DMR to confirm whether a Waste Management License (WML) is required.

5.1.12 Mine Health and Safety Act (no. 29 of 1996) [as amended]

The following is an extract from the Act:
"Objectives of Act:

1. The objectives of this Act are:
   (a) To protect the health and safety of persons at mines;
   (b) To require employers and employees to identify hazards and eliminate, control and minimise the risks relating to health and safety at mines;
   (c) To give effect to the public international law obligations of the Republic that concern health and safety at mines;
   (d) To provide for employee participation in matters of health and safety through health and safety representatives and the health and safety committees at mines;
   (e) To provide for effective monitoring of health and safety conditions at mines;
   (f) To provide for enforcement of health and safety measures at mines;
   (g) To provide for investigations and inquiries to improve health and safety at mines; and
   (h) To promote –
      (i) A culture of health and safety in the mining industry;
      (ii) Training in health and safety in the mining industry; and
      (iii) Co-operation and consultation on health and safety between the State, employers, employees and their representatives"

The construction and operational activities associated with the proposed chrome mine must be in accordance with the requirements of the Act.

5.1.13 National Veld and Forrest Fire Act (no. 101 of 1998)

The purpose of the act is to prevent and combat veld, forest and mountain fires throughout the Republic. The act provides for a variety of institutions, methods and practices for achieving the purpose. There is a risk of veld fires during the construction, operational and decommissioning phases of the mine. The Applicant and all contractors and employees have roles and responsibilities in terms of this act that have to be implemented.

5.1.14 Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended]

The following sections of the act is relevant to the application:

- *Section 2 - Declaration of grouped hazardous substances;*
- *Section 4 - Licensing;*
- *Section 16 - Liability of employer or principle; and*
- *Section 9 (1) - Storage and handling of hazardous chemical substances; and*
- *Section 18 - Offences.*

The Applicant must ensure the safety of people working with hazardous chemicals (specifically fuels), as well as safe storage, use and disposal of containers during the on-site operational phase together with the associated liability should non-compliance be at the order of the day.

5.1.15 Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995)

The following sections of the act is relevant to the application:

Section 4 - Duties of persons who may be exposed to hazardous chemical substances; and
Section 9A (1) - Penalties.

Hazardous substances will be stored and utilised on the site and non-compliance to management measures will result in prosecution of the Applicant in terms of his liabilities to the socio-economic environment.

5.2 Provincial legislative framework

Table 9: Provincial legislation, policies and guidelines considered

TITLE OF LEGISLATION, POLICY OR GUIDELINE	APPLICABILITY TO THIS PROJECT	ADMINISTERING AUTHORITY	DATE
DEA&DP and DEA Guidelines on Public Participation	Used as a guide to inform of the public participation process.	• Department of Environmental Affairs; and • Development Planning Department of Environmental Affairs	2012
DEA&DP and DEA Guidelines on Alternatives	Used as a guide to inform on the use and presentation of alternatives in the EIA process.	• Department of Environmental Affairs and Development Planning; and • Department of Environmental Affairs	2012
DEA&DP and DEA Guidelines on Need and Desirability	Used as a guide to inform on the need and desirability in conjunction with the above mentioned SDFs and IDPs.	• Department of Environmental Affairs and Development Planning • Department of Environmental Affairs	2013
Bojanala District Municipality Integrated Development Framework	This plan was consulted to inform the Need and Desirability of the proposed development as the Socio-Economic characteristics of the area. In addition, this plan was consulted to inform whether the proposed development is aligned with the objectives and strategies of the municipality's planning objectives.	Bojanala District Municipality	Unknown
Bojanala District Municipality Fire services By-law (Local Authority Notice no. 204)	The development should take the requirements of this by-law into consideration.	Bojanala District Municipality	2004
Disaster Management Act (no. 57 of 2002)	Provides an integrated and co-ordinated disaster management policy that focuses on preventing or reducing the risk of disasters,	Bojanala District Municipality	2002

	mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery. Furthermore the establishment of national, provincial and municipal disaster management centres and also identifying disaster management volunteers to identify and manage matters incidental to disasters.		
Spatial Development Framework for the North West Province	The Provincial Spatial Development Framework (PSDF) is designed to act as planning tools for all spheres of government to ensure that synergy and maximum impact are obtained in a sustainable manner by the development efforts.	North West Provincial Government	Unknown

6. DESCRIPTION OF THE BASELINE ENVIRONMENT [REGULATION 31 (2) (d)]

6.1 Physical environment

6.1.1 Climate

Climatic data was obtained from the DWS weather station Hartbeespoort dam for the Hartbeespoort/Brits area. The proposed opencast mine is located in the summer rainfall region of Southern Africa with precipitation usually occurring in the form of convectional thunderstorms. The average annual rainfall (measured over a period of 70 years) is approximately 688.20mm, with the high rainfall months between October and March (Rambau, et al. 2013).

Furthermore it is located approximately 900 m above sea level. Maximum temperatures during summer exceed 30°C and maximum winter temperature averages 23°C (Mare, 2013).

Table 10: Minimum and maximum temperatures (Mare, 2013)

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	12.2	11.2	10.7	8.7	0.8	2.3	1.7	1.7	1.8	2.4	5.2	9.9
Maximum	34.3	33.3	30.6	34.0	31.7	29.3	27.0	27.2	25.8	35.2	36.7	36.0

Table 11: Climatic Data for the Hartbeespoort dam/Brits Area (Rambau, et al. 2013)

Month	Average Monthly Rainfall (mm)	Mean Monthly Evaporation
January	124.30	190.80
February	94.10	163.70
March	85.60	150.40
April	46.10	116.60
May	19.00	93.40
June	8.80	72.20
July	5.10	82.20
August	5.80	116.50
September	15.40	159.10
October	60.30	191.50
November	109.30	191.30
December	114.00	199.10
Annual	688.20	1731.9

6.1.2 Geology

The 2526 Rustenburg 1:250 000 geology series map indicates that the investigated area is predominantly underlain by rocks of the Rustenburg Layered Suite of the Bushveld Igneous Complex (BIC) as indicated by Figure 3.

The Rustenburg Layered Suite is divided into five zones, namely:

- Upper Zone
- Main Zone
- Critical Zone
- Lower Zone
- Marginal Zone (Rambau, et al. 2013).

The proposed site is stratigraphically within the Main Zone of the Rustenburg Layered Suite of the Bushveld Igneous Complex. The Main Zone is a succession of norite and gabbro-norite with minor anorthosite and pyroxenite layers. Its termination with regards to the overlying Upper Zone is indicated by a cumulus pyroxenite marker (Rambau, et al. 2013).

The chromitite layer resources in South Africa are situated within the Bushveld Complex (BC), which is an enormous saucer-like ultramafic/mafic intrusion extending for about 400km from east to west and roughly 280 km distance north to south. The ultramafic/mafic rocks of the BC are collectively known as the Rustenburg Layered Suite (RLS) and have been subdivided, from base to top, into five zones, known as the Marginal, Lower, Critical, Main and Upper Zones. The general sequence and composition of the different zones is shown in Figure 6. The continuity of the Critical Zone is intermediate between that of the Lower Zone and Main-Upper Zones. The Critical Zone is the host to all chromium and PGM mineralisation within the BC. The igneous layering within the Critical Zone is remarkably uniform over much of the BC, with individual layers traceable for tens to hundreds of kilometres. It may be subdivided into lower and upper sections and is made up of cyclic units consisting of chromitite, pyroxenite, norite and anorthosite. Cycles in the Lower Critical Zone are entirely ultramafic in character. Cycles in the Upper Critical Zone comprise

ultramafic lithologies and also norite-anorthosite. Chromitite layers occur throughout the Critical Zone, usually, but not always, at the base of crystallisation cycles (McQuade, 2013).

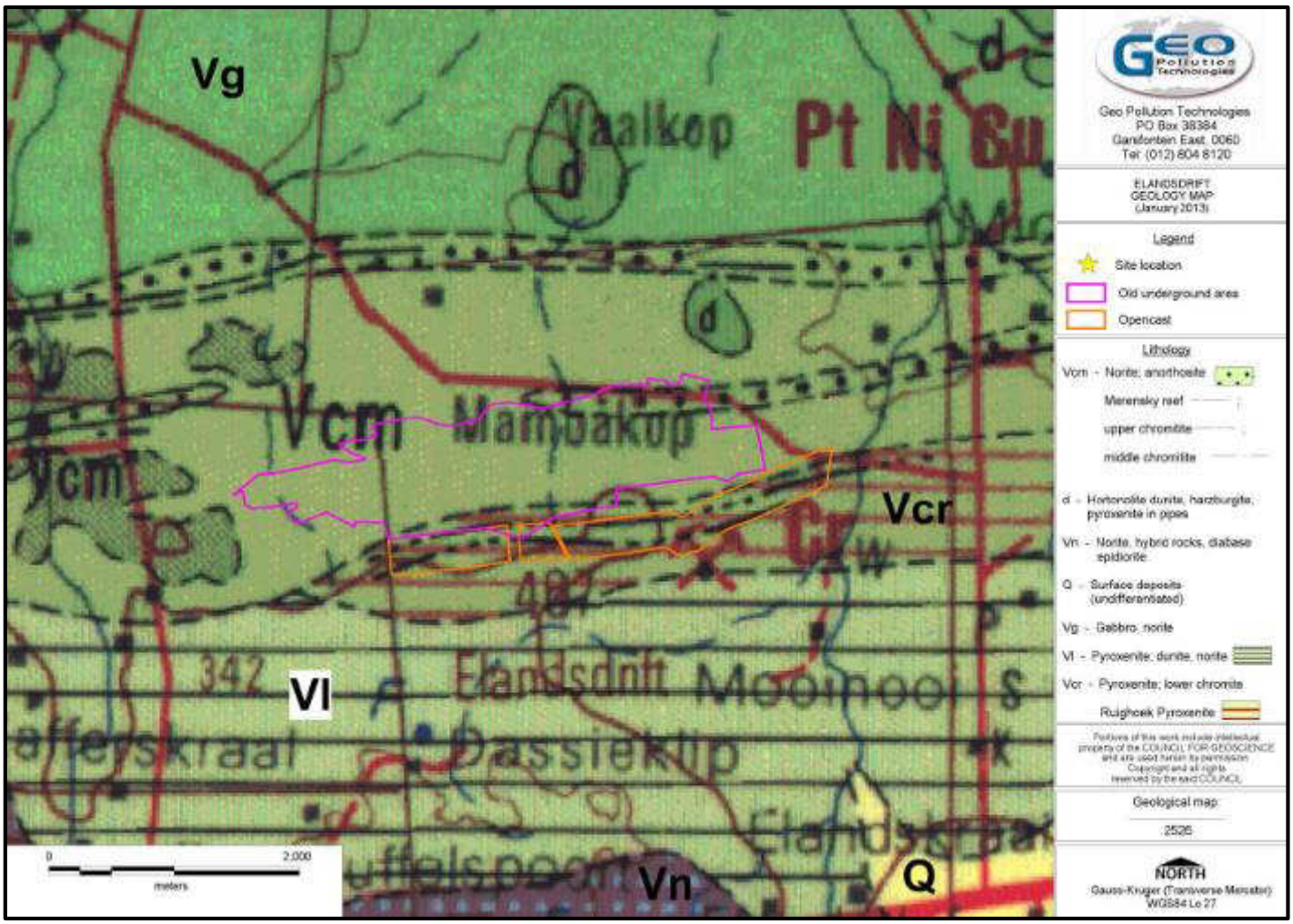


Figure 3: Regional geology (Rambau, et al. 2013)

The chromitite seams have been classified into lower, middle and upper groups, with the Lower Group occurring in the Lower Critical Zone and the Upper Group in the Upper Critical Zone. The Middle Group chromitite seams straddle the boundary between lower and upper divisions of the Critical Zone. The chromitite seams are named according to their location within the layered succession, with numbers commencing from the bottom up, with the lowermost group being named LG1, followed by LG2, LG3, etc. in the Lower Group (consisting of 7 layers), progressing to MG0, MG1, MG2, etc. (consisting 4 layers) in the Middle Group, and then on two layers in the Upper Group, UG1 and UG2. The thickness of these chromitite layers ranges from several millimetres to several metres and named chromitite layers may comprise multiple, composite layers of chromitite separated by interlaminated silicate rocks. The thickest chromitite layers, specifically the LG6 and MG1, are mined for their chrome content. The target area of this application is underlain by rocks of the Lower Critical Zone and Upper Critical Zone of the BC, consisting of chromitite interlayered with pyroxenite, norite, anorthositic norite, and mottled anorthosite (McQuade, 2013).

The reference section for the Middle Group chromitite layers, MG0 to MG4, is in the Mooinooi (Marikana) Section (Figure 5). Economically, the most important of the Middle Group chromitite layers is the MG1 chromitite layer which averages 1.32m in thickness. The four chromitite layers within this group are often developed as multiple chromitite layers. Thus, the MG1 seam contains two thinner chromitite layers as well as a number of chromitite stringers below a 1.28m thick chromitite layer. The MG1 Chromitite layer is poikilitic and fine grained. Top and basal contacts may be sheared, but range from gradational to sharp. A thin (1-4cm) chromite disseminated layer is developed in the center of the seam (McQuade, 2013).

The Middle Group Chromitite seams

The Middle Group consists of the rock types: pyroxenite, norite, anorthosite and chromitite. The MG1 chromitite seam is of particular economic significance. The MG1 chromitite seam is separated from the MG2 chromitite layer above by a pyroxenite unit which is 12.5 m thick. An anorthosite layer (4.5 m thick) separates the MG2 and MG3 chromitite seams (McQuade, 2013).

MG4A Chromitite Layer

The MG4A layer is developed within pyroxenite, overlain by an average of 1.46m coarse grained pyroxenite. Both top and basal contacts are gradational. The ore is fine grained, solid and well packed. Pyroxenite bands or lenses may occur in the bottom 30cm of this layer. Immediate hanging and footwall pyroxenite is solid, unaltered and seldom broken. The MG4A layer is separated from the MG4 layer by fine to medium grained pyroxenite with an average thickness of 2.00m (McQuade, 2013).

The MG4 Chromitite Layer

The MG4 layer with sharp top and basal contact is a fine grained well packed chromitite. It usually includes a pyroxenite band up to 65cm in the top half of the layer, with an average of 5cm. Immediate hanging is solid fine to medium grain pyroxenite. The immediate footwall consists of a unit with alternating chromite stringers, disseminated chromite in anorthosite and pyroxenite layers. This unit averages 2.38 m in thickness (McQuade, 2013).

The MG3 Chromitite Layer

The MG3 Chromitite Layer is a single 1,05m thick chromitite layer, with characteristic anorthositic/noritic lenses in the top 8cm, fine grained and well packed. Anorthositic blebs and bands are common throughout the unit. The top and bottom contacts are sharp and gradational respectively. Chromitite schlieren are common in the first 22cm of the hanging wall above the chromitite. The parting between the MG3 chromitite and the MG4 chromitite layers averages 16.6m and comprised mainly of light-brown to greyish fine to medium grained norite (McQuade, 2013).

The MG2C Chromitite Layer

The MG2C Chromitite Layer is the top layer of the composite MG2 layer. A distinctive fine to medium grained mottled anorthosite unit with an average thickness of 4.43m forms the parting between the MG2C layer and the MG3 layer. The MG2C is a fine grained moderately to well packed chromitite unit with oikocrysts developed throughout and has an average thickness of 0.43m. Top and basal contacts are usually sharp. The top contact grades from light to medium disseminated chromite into anorthosite, often broken and sometimes sheared. The sharp bottom contact is sometimes broken, sheared and altered. Both top and bottom contacts can be regarded as zones of weakness. A thin 2-4cm pyroxenite band is often developed in the top half of the chromitite layer, with broken top and bottom contacts and sometimes sheared (McQuade, 2013).

The MG2B Chromitite Layer

The MG2B Chromitite Layer is a fine grained well packed chromitite unit with oikocrysts developed throughout and has an average thickness of 0.55m. The top and bottom contacts are usually sharp. It is separated from the MG2C layer by a fine to medium grained pyroxenite which averages 1.50m and increase in thickness northwards to 2.48m at approximately 850m depth below surface. This pyroxenite carries a chromitite band followed by alternating stringers and disseminated chromite that is situated approximately 0.3m above the top contact of the MG2B. This unit averages 0.3m in thickness (McQuade, 2013).

The MG2A Chromitite Layer

The MG2A Chromitite Layer is a fine grained well packed chromitite unit with oikocrysts developed throughout and has an average thickness of 0.48m. The pyroxenite parting thickness between the MG2A and MG2B is variable, sometimes not developed but average 6cm. It thickens towards the west in the area described and thins towards the east. The bottom contact of the MG2B is transitional while the top contact is usually sharp (McQuade, 2013).

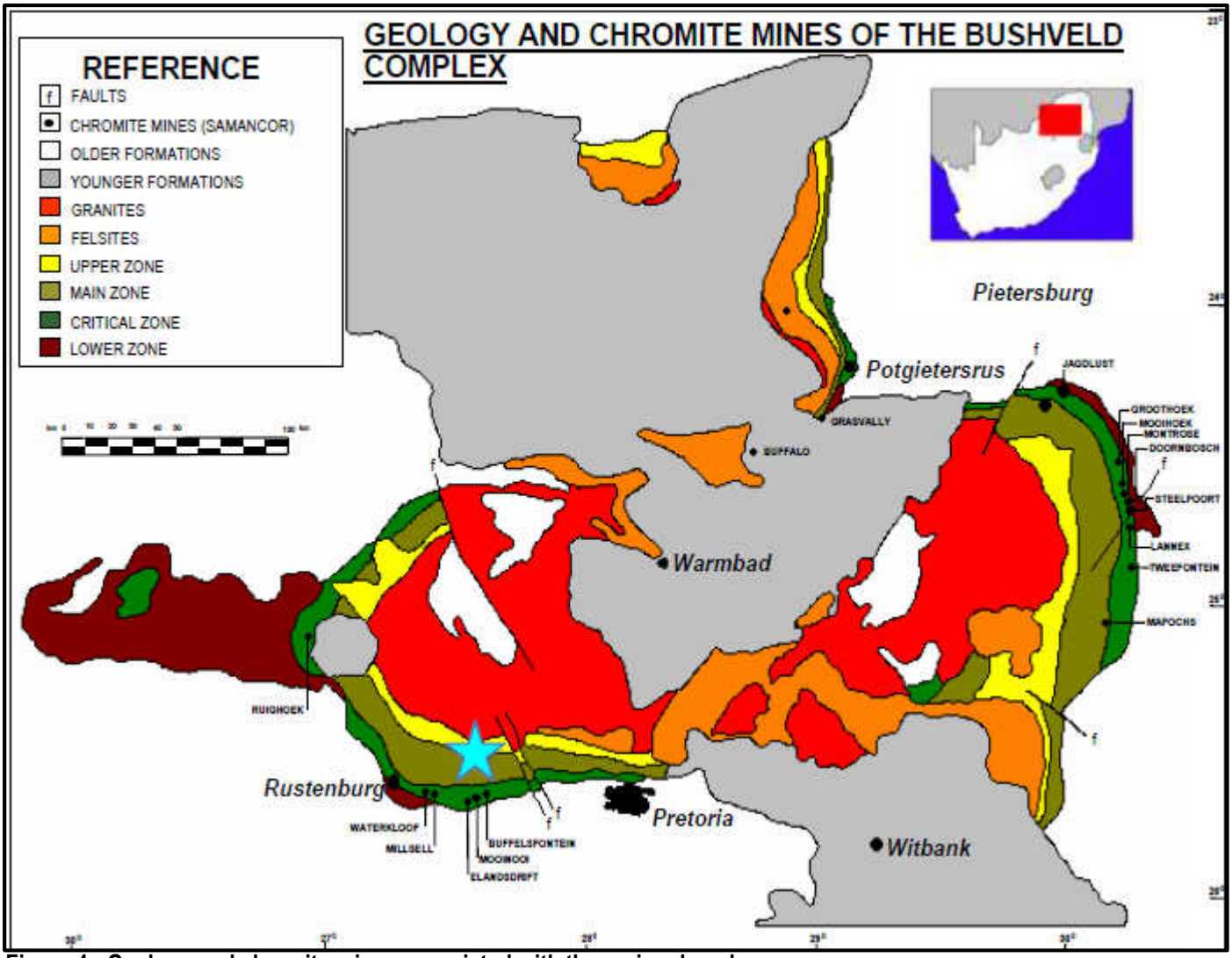


Figure 4: Geology and chromite mines associated with the regional geology

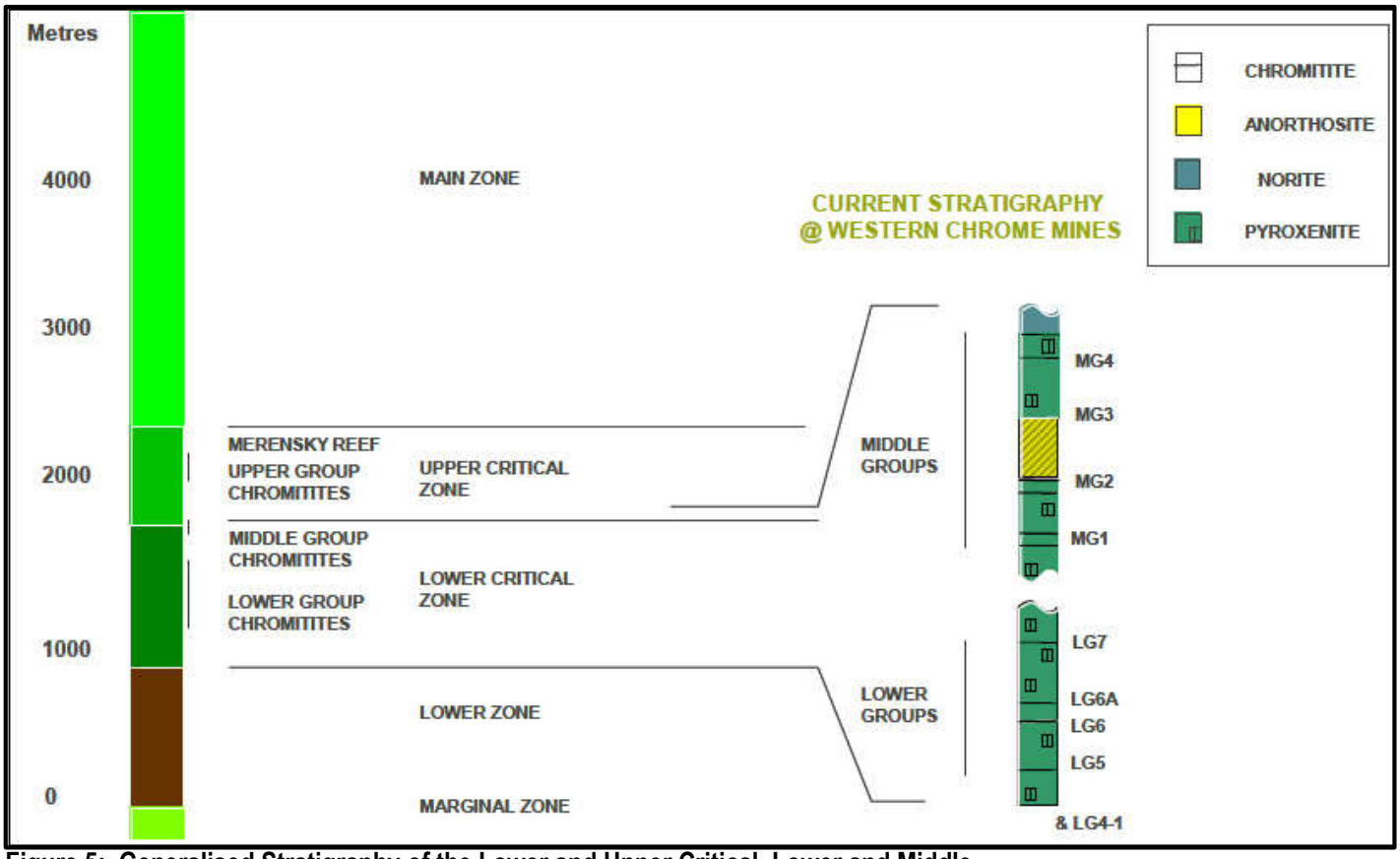


Figure 5: Generalised Stratigraphy of the Lower and Upper Critical, Lower and Middle

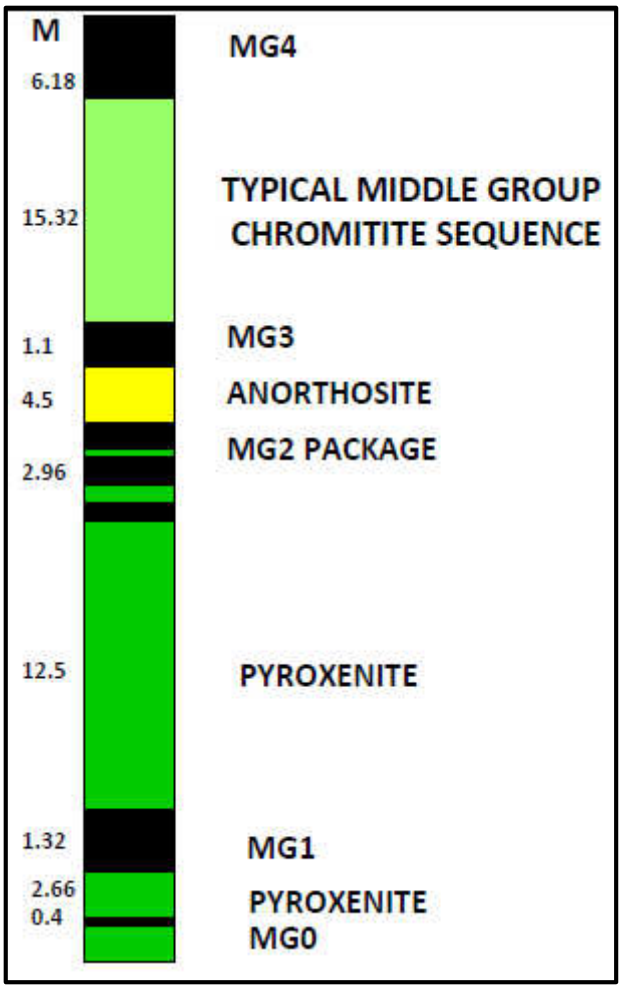


Figure 6: Stratigraphy of the Middle Group Chromitite Seams

The MG1 Chromitite Layer

The MG1 Chromitite Layer is a moderately to well packed fine grained chromitite layer with oikocrysts developed throughout. The characteristic disseminated parting within the MG1 is developed near the centre of the layer. A transitional "frozen" top contact is developed in the immediate hanging pyroxenite which general is fairly solid. The bottom contact is usually sharp. The immediate footwall is in general broken for the first 15cm but consist of a fairly unaltered pyroxenite. An exception to this is clay layering that may be developed in the footwall of the MG1 to the west of Elandsdrift on the farm 342JQ. The pyroxenite parting between the MG1 and MG2A chromitite layers averages 13m consisting of fine to medium grained pyroxenite in general fairly solid.

Variation in dip

- The mean dip is 12.4º with a minimum of 9º and a maximum of 20º.

Seam thickness variation

- The thickness of the seam varies with a minimum of 1.1m and a maximum of 2.7m. On the farm Middelkraal it is expected to average 1.3m and on Elandsdrift farm 1.28m

Grade variation

- The MG1 grade is expected to average 41.5 % Cr_2O_3 with a Cr:Fe ratio of 1.5:1
- The chrome content varies from 37.01 to 43.02. RD varies between 3.9 to 4.40 (McQuade, 2013).

The MG0 Chromitite Layer

The MG0 Chromitite Layer is a well packed fine grained chromitite layer with larger oikocrysts than those developed in the MG1. Characteristically sharp top and basal contacts are developed. The 2.70 m pyroxenite parting between the MG0 and MG1 carries a 37cm thick unit consisting of chromite stringers and highly disseminated chromite, which lies on average 0.97m above the MG0.Two 8cm thick distinctive chromitite bands are developed in the footwall pyroxenite 15cm and 40cm below the MG0 layer. Previous and current exploration activities include the intersection of the Middle Group Chromitite (MG1 and MG2) layers in a total of 177 diamond drill holes. Exploration was done under an existing old order mining right (Mining Authorisation numbers ML 21/1994) (McQuade, 2013).

Opencast Exploration Results

The initial drilling programme was based on historical drilling results. The drilling programme was designed to intersect the MG0, MG1, MG2, MG3 and MG4 seams at 25m – 50m below surface and each drilling line was spaced 150m apart, and then filled in at 75m. Trenching was also conducted along strike to determine the sub-outcrop positions of the chromitite seams. Drilling and trenching also proved that the ore body is shallow dipping, ranging from dips of 9° to 13° over the opencast able area. Samancor Chrome captured this borehole information into GBis, (Geological Borehole Information System, a geological database and is exported into Minex (Gemcom), a geological modelling, software package. Specific chromitite layers that were modelled include the MG0, MG1, and MG2 package. The MG3 layer and the MG4 package of chromitite layers were not modelled due to its low chrome content and lack of demand. This has allowed Samancor to report in situ resource in line with the company's resource reporting procedure. The results of this have prompted Samancor to apply for the amendment to the existing mining right to include the opencast resource (McQuade, 2013).

6.1.3 Soil and land capability

A broad soil classification and soil sampling for chemical analysis were done to get a baseline of the soil types, agricultural potential and land capability for the proposed Samancor opencast chrome mine expansion. A Dutch soil auger was used to do a free survey. It was not possible to do a fixed grid as the terrain was inaccessible with thick thorn bush and rocky outcrops. Any differences in soil types or depth, or any other soil physical properties that can have an influence on the soil forms and agricultural potential of this land of the proposed opencast mine was identified. Representative soil samples were also taken to determine the chemical composition of the different soil types. The soil samples were sent to Eco-Analytica in Potchefstroom. A GPS was used to log these points for future reference (Botha, 2012).

The soils that occur on the proposed development are as follow:

- **Arcadia (Ar):** It has a Vertic A Horizon over unconsolidated material over saprolite. The soil varies from 40 – 90 cm in depth. It has a low to medium potential agricultural production capacity.
- **Glenrosa (Gs)**: It has an Orthic A Horizon over a hard Lithocutanic B Horizon. The soils vary from 20 – 40 cm in depth. There are large boulders on the surface. It is marginal for agricultural production.
- **Mispah (Ms)**: It has a thin Orthic A Horizon solid rock. The soils vary from 10 - 30 cm in depth. There are large boulders on the surface. It is marginal for agricultural production.
- **Oakleaf (Oa)**: It has an Orthic A Horizon over a Neocutanic B Horizon. The soil varies in depth from 75 -100 cm. They are highly erodible and therefore low to medium potential soils (Botha, 2012).

There is a large portion of the study area that is already disturbed with previous mining activity, spoils dumps and built up areas. The following soil types can be grouped together based on their physical features and land capability classification (Botha, 2012).

Table 12: Soil physical properties for the different soil forms (Botha, 2012)

Properties	Soil 1	Soil 2	Soil 3	Soil 4
Soil form	Arcadia	Glenrosa	Mispah	Oakleaf
Sub Dominant soil		Mispah	Glenrosa	Hutton
Soil family	1200	1211	1100	1110
Soil Depth	40-80cm	20-40cm	0-20cm	80-100cm
Effective rooting depth	40cm	20cm	20cm	60cm
Infiltration rate	Low <5mm/h	Moderate 5-10mm/h	Low <5mm/h	Moderate 5-10mm/h
Consistency	Hard	Friable	Friable	Friable
Structure	Strong Blocky	Apedal	Apedal	Loose
Texture	Cl	Sa Cl Lm	Lm Sa	Lm Sa
Drainage	Slow	Moderate	Fast	Fast
Gravel/Rocks A Horizon	20%	40%	80%	10%-
Gravel/rocks B1 Horizon	30%	80%	100%	30%
Gravel/rocks B2 Horizon	-	-	-	-
Wetness	W 1	-	-	-
Compactability	Low	Low	Low	High
Erodability	High	Very High	Very High	Very High
Potential Nematode Infestation	Low	Low	Low	High
Irrigation classification	5	5	5	4
Land capability (Ag)	4	4	8	4
Land Capability (mining)	Grazing/ Arable	Grazing	Wilderness	Arable

Table 13: Classification of land capability classes (Botha, 2012)

Soil Management Unit	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Soil Types	Soil 1	Soil 1	Soil 1	Soil 2, 3	Soil 4
Limiting Factors	Drainage, Depth	Drainage, Depth	Drainage, Depth	Rock	Disturbed
Effective Depth cm	40	40	40	20	60
Agricultural potential	Low/ Medium	Low/ Medium	Low/ Medium	Marginal	Medium
Irrigation Classification	5	5	5	5	4
Irrigations systems	All	All	All	None	All
Recommended Land use	Grazing / Arable crops	Arable crops	Arable crops	Wilderness	Arable crops
Land Capability	(4) Arable	(4) Arable	(4) Arable	(8) Wilderness	4

6.1.4 Topography and hydrology

Reference is made to the Geohydrological Study by Rambau dated 2013.

The topography can normally be used as a good first approximation of the hydraulic gradient in an unconfined aquifer. This discussion will focus on the slope and direction of fall of the area under investigation, features that are important from a groundwater point of view. The area is characterised by a generally flat topography in the area of the proposed mine site. Regionally, drainage flows from south to north. Locally, drainage is northeast to the Elandsdriftspruit located in the east of the proposed mine. Most of the existing surface water bodies are seasonal including the Elandsdriftspruit that is within the mining concession area. The Rustenburg Layered Suite rocks typically act as secondary aquifers (intergranular and fractured rock aquifers). However, the multi-layered weathering system present on these rocks could prove to have up to two aquifer systems present in the form of a shallow, saprolitic aquifer with a weathered, intergranular soft rock base associated with the contact of fresh bedrock and the weathering zone; and a fractured bedrock aquifer. These aquifer systems are discussed below:

Shallow, saprolitic aquifer

The main source of recharge into the shallow aquifer is rainfall that infiltrates the aquifer through the unsaturated (vadose) zone. Vertical movement of water is faster than lateral movement in this system as water moves predominantly under the influence of gravity. This aquifer may contain transported, coarse, anorthositic sediment or turf clay sediment when underlain by norite. The hydraulic conductivity of this aquifer ranges between 10-8 and 10-2m/day and porosity ranges between 0.4 and 0.7 for turf clay sediments. The hydraulic conductivity of the coarse, anorthositic sediment can reach up to 20m/day with porosities ranging between values of 0.25 to 0.5.

Fractured, bedrock aquifer

Groundwater movement is predominantly associated with secondary structures in this aquifer (fractures, faults, dykes, etc.). The average water level depth in the area ranges between 5 and 40mbgl. Borehole yields in the Rustenburg Layered Suite fractured aquifers are generally low and can be expected to be between 0.1 and 2 l/s with regional flow resembling flow in the porous medium (i.e. obeying Darcy's law). These formations contain limited quantities of water resources due to the poor storage capacity of the igneous rock. Groundwater quality in the area is also expected to be intermediate to poor with EC values ranging from 4.4 to 120mS/m and possibly elevated Ca, Mg, Cl, and SO_4 as well as carbonate alkalinity concentrations. Both the porosity and the hydraulic conductivity of the Rustenburg Layered Suite fractured aquifers are known to be low. The commonly expected values of porosity and permeability for igneous rock types, similar to those present in the Rustenburg Layered Suite, are 0.05 (porosity) and

10-5 m/d (hydraulic conductivity) respectively. Movement of groundwater in this aquifer will be preferential in secondary structures such as joints, faults and fractures.

6.1.5 Groundwater

Reference is made to the Geohydrological Study by Rambau dated 2013.

A hydro census was conducted for the proposed Elandsdrift opencast and the surrounding area, during November 2012. The position of all the boreholes relative to the proposed mine area is presented in Figure 10. A total of 14 boreholes and 4 surface water bodies were identified during this hydro census study. Groundwater levels, varying between 7.46m and 18.40m below ground level, were measured in the surrounding area during the survey. These values were determined from borehole data where the owner was available on site and where it was possible to gain access to the boreholes for precise measuring of water levels. Usually a good relationship should hold between topography and static groundwater level. This relationship can be used to distinguish between boreholes with water levels at rest, and boreholes with anomalous groundwater levels due to disturbances such as pumping or local geohydrological heterogeneities. For the water levels measured a good correlation is found between static water level and surface indicating that significant abstraction has not influenced the regional water level.

This general relationship is useful to make a quick calculation of expected groundwater levels at selected elevations, or to calculate the depth to the groundwater level (unsaturated zone):

- Groundwater level = Elevation x 0.9365
- Depth to the groundwater level = Elevation x (1 - 0.9365) = Elevation x 0.0635.

However, due to the heterogeneity of the subsurface, these relationships should not be expected to hold everywhere under all circumstances, and deviations could thus be expected. These static water levels were also subtracted from the elevations to determine the unsaturated aquifer thicknesses of different points over the study area. These values are intrinsically the same as the depth to the natural groundwater level measured from the surface. The average depth to the groundwater levels in the fractured aquifer in the proposed mining area is 11 mbgl. A correlation relationship between the elevation and the static water level was found to be 98.5%, which is a good fit or shows a good relationship. Groundwater flow direction should be perpendicular to these contours and inversely proportional to the distance between contours. Using this relationship, the inferred groundwater flow directions are presented in Figure 8. As can be expected, the groundwater flow is mainly from topographical high to low areas, eventually draining to local streams in the north-north easterly direction. Five water samples were collected from hydro census boreholes and streams around the site during the investigation. The samples were submitted for major cation and anion analyses to determine water quality in the area. The groundwater results are compared with the maximum recommended concentrations for domestic use as defined by the DWS Water Quality Guidelines.

The DWS guidelines are classified as:

- Class 0 which is ideal concentrations
- Class I which is considered as acceptable
- Class II which stipulates the maximum allowable concentration of the water constituent, which can be tolerated only for a limited period.

The results shows that both the individual ions present in a water sample and the total ion concentrations in meq/L or mg/L. The scale for the radius of the circle represents the total ion concentrations, while the subdivisions represent the individual ions. It is very useful in making quick comparisons between waters from different sources and presents the data in a convenient manner for visual inspection. A Stiff pattern is basically a polygon created from four horizontal axes using the equivalent charge concentrations (meq/L) of cations and anions. The cations are plotted on the left of the vertical zero axis and the anions are plotted on the right. Stiff diagrams are very useful in making quick comparisons between waters from different sources. On the piper diagram the cation and anion compositions of many samples can be represented on a single graph. Certain trends in the data can be discerned more visually, because the nature of a given sample is not only shown graphically, but also show the relationship to other samples. The

relative concentrations of the major ions in mg/L are plotted on cation and anion triangles, and then the locations are projected to a point on a quadrilateral representing both cation and anions.

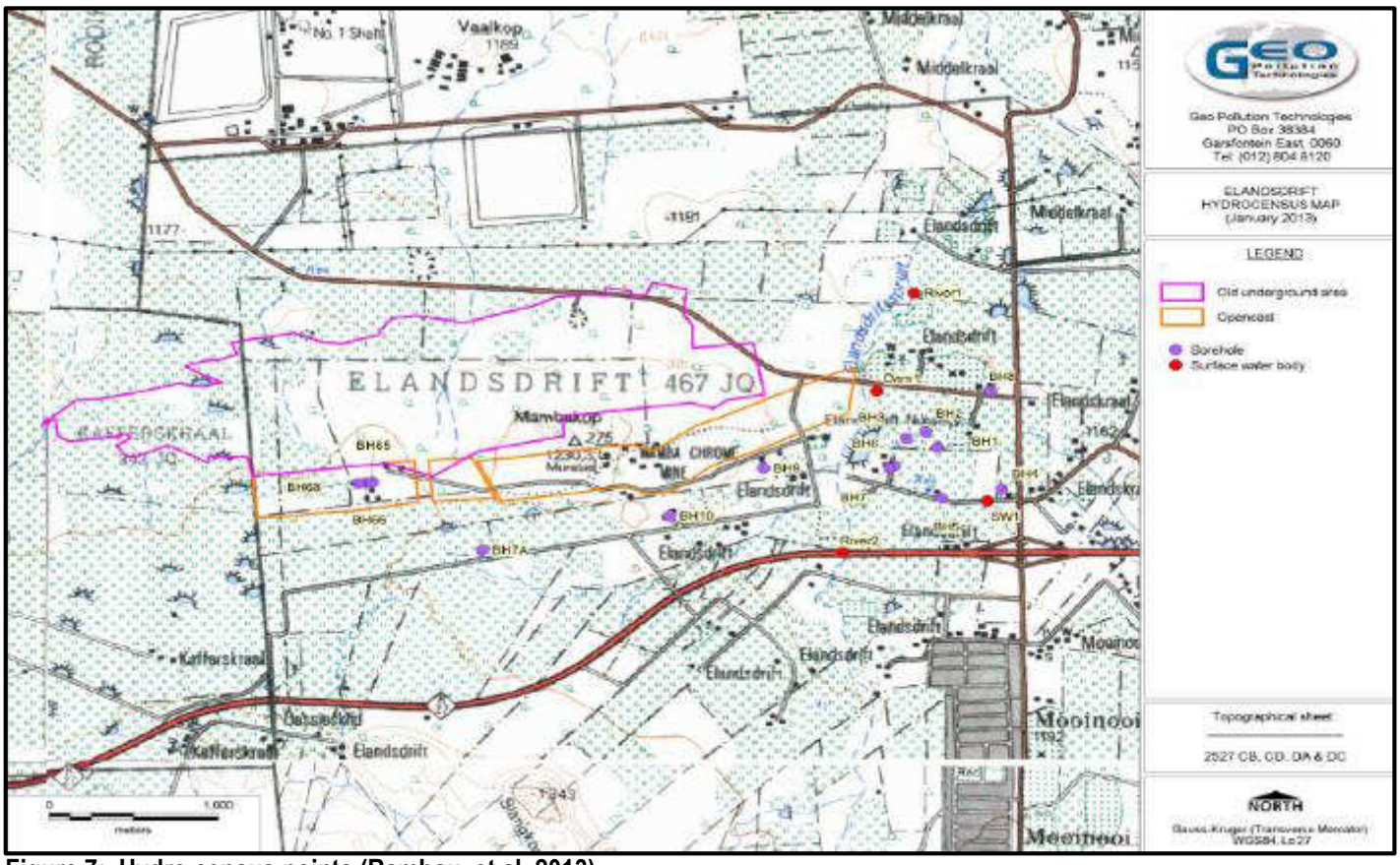


Figure 7: Hydro census points (Rambau, et al. 2013)

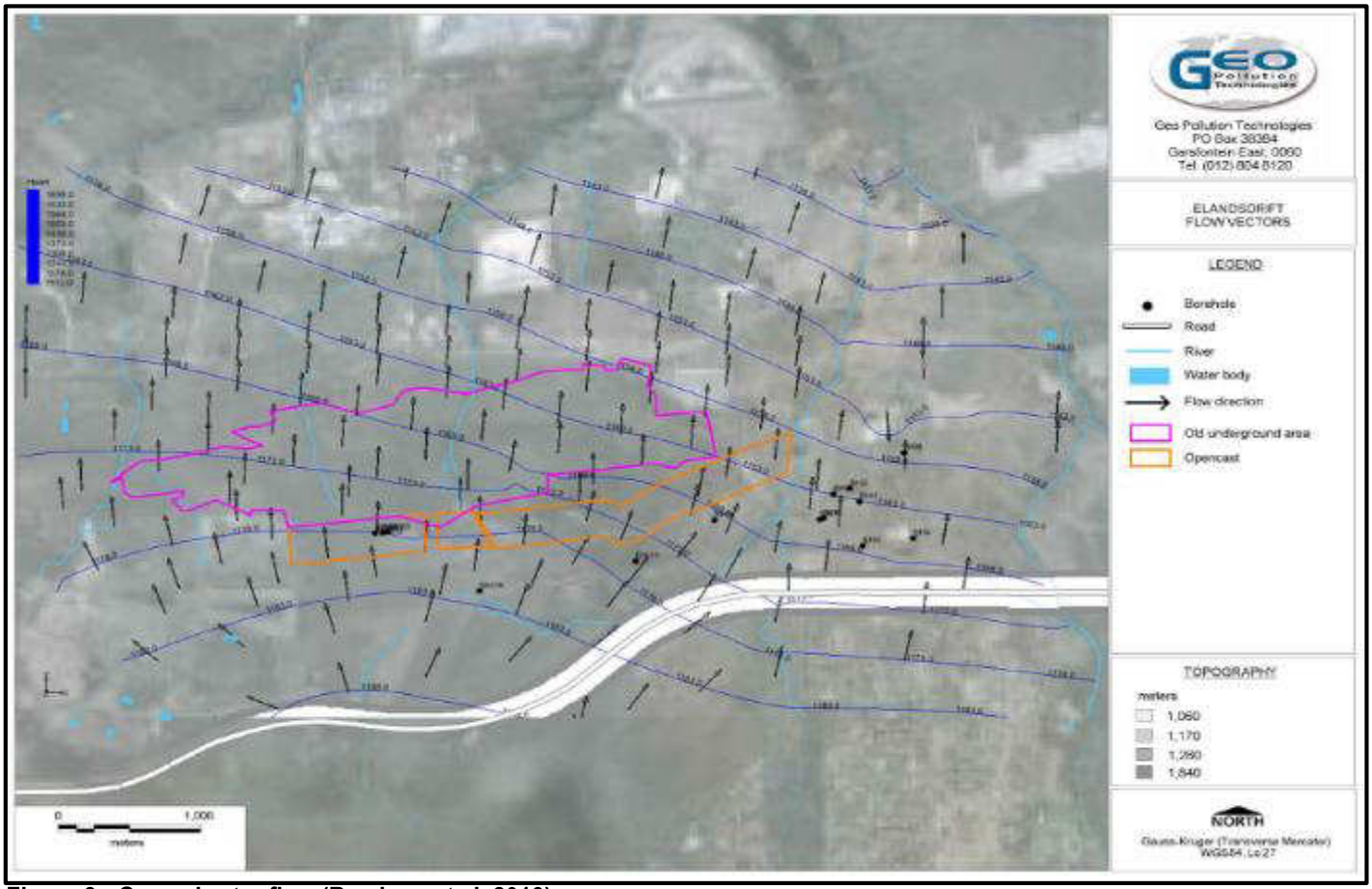


Figure 8: Groundwater flow (Rambau, et al. 2013)

6.1.6 Surface water

Reference is made to the Surface Water Assessment attached as Annexure 3.3.

Water quality data was obtained from the database of the Directorate: Resource Quality Studies a point in the Crocodile River below the project area. The downstream point was at the weir on the Roodekopjes Dam (A2H019: WMS A421-90332). Water quality data is available from 21 January 1976 until 16 September 2000. It is evident that the water quality is good with no variable exceeding the Target Water Quality Range (TWQR) for drinking water.

Table 14: Background water quality data for the Crocodile River catchment

VARIABLE	WMS A 421-90332	TWQR
Electrical Conductivity in mS/m	8.8	<70
pH	7.4	6.5 – 9.0
Sodium as Na in mg/l	6.5	<100
Potassium as K in mg/l	1.4	0-50
Calcium as Ca in mg/l	5.0	<32
Magnesium as Mg in mg/l	2.7	<30
Chloride as Cl in mg/l	7.9	0-100
Sulphate as SO_4 in mg/l	4.8	0-200
Total Alkalinity as TAL in mg/l	27.2	-
Fluoride as F in mg/l	0.13	0-1
Phosphate (PO_4) as P in mg/l	0.017	<5
Nitrate (NO_3) and Nitrite (NO_2) as N in mg/l	0.05	<6
Ammonium (NH_4) as N in mg/l	0.033	0-1

In addition, water quality data is also available for the confluence of the Sterkstroom (at Middelkraal Dam) with the Maretlwane before the final inflow into the Roodekopjes Dam. The median values for the variables monitored at stations ED07 and ED08 are provided below:

Table 15: Background water quality data for the Sterkstroom

VARIABLE	DOMESTIC USE		UNIT	BACKGROUND	SAMPLING POINT 2008-2009	
	TWQGR	Tolerable		1999	Upstream (ED07)	Downstream (ED08)
pH	6 - 9	5 - 9.5		8.16	8.11	8.17
TDS	450	1000	(mg/l)	203	140.78	140.89
EC	70	150	(mS/m)	29	27.32	26.54
Hardness	200	300	(mg/l)		130.37	127.31
Ca	80	150	(mg/l)	18	16.36	16.09
Mg	70	100	(mg/l)	9	21.61	21.03
Na	100	200	(mg/l)	22	6.51	6.06
K	25	50	(mg/l)	14.5	0.31	0.04
Alkalinity	500	-	(mg/l)	88	122.68	120.22
Cl	100	200	(mg/l)	9	4.47	3.39
SO_4	200	400	(mg/l)	26	11.16	11.11
F	0.7	1	(mg/l)	0	0.15	0.00
Fe	0.5	1	(mg/l)	0	0.34	0.25
Mn	0.1	0.4	(mg/l)	0.026	0.02	0.00
Al	0.15	0.5	(mg/l)		0.29	0.18
PO_4	2	-	(mg/l)	0	0.02	0.02

VARIABLE	DOMESTIC USE		UNIT	BACKGROUND	SAMPLING POINT 2008-2009	
	TWQGR	Tolerable		1999	Upstream (ED07)	Downstream (ED08)
NO_3	6	10	(mg/l)	4.4	0.06	-0.06
NH_3	1	2	(mg/l)		0.13	0.09
SAR	2	-	(mg/l)		0.25	0.24
Cr^{6+}	0.05	1	(mg/l)	0		

Water quality for this monitoring point is also indicative of good quality with only aluminium a variable of concern noted. The low sulphate concentrations as a Key Performance Indicator of mining related pollution illustrate low impact from this industry on the catchment.

Table 16: Location of monitoring points in Sterkstroom

MONITORING STATION	LONGITUDE	LATITUDE
ED07	23° 58'20.06" S	27° 43'33.38" E
ED08	23° 36'06.69" S	27° 44'28.67" E

A preliminary intermediate Reserve study for the A21 catchment had been conducted by the Department of Water and Sanitation during March 2011 under reference 26/8/3/3/54. The project area falls within quaternary drainage areas A21. An intermediate determination of Reserve for Water Quantity in terms of sections 14(1)(b) and 17(1)(a) of the NWA had been conducted to support water use license applications.

Table 17: Water Quantity Reserve for A21K quaternary drainage area

MONTH	NATURAL FLOWS			MODIFIED FLOWS (IFR)			
				LOW FLOWS		HIGH FLOW	TOTAL FLOW
	MEAN	SD	CV	MAINTENANCE	DROUGHT	MAINTENANCE	MAINTENANCE
Oct	0.211	0.074	0.131	0.077	0.033	0.004	0.081
Nov	0.308	0.253	0.317	0.082	0.035	0.018	0.100
Dec	0.453	0.407	0.336	0.085	0.036	0.055	0.140
Jan	0.635	0.636	0.374	0.093	0.039	0.027	0.120
Feb	0.927	1.165	0.519	0.112	0.047	0.200	0.312
Mar	0.843	0.968	0.428	0.103	0.043	0.094	0.198
Apr	0.619	0.565	0.353	0.100	0.042	0.048	0.148
May	0.364	0.183	0.188	0.089	0.038	0.000	0.089
Jun	0.297	0.097	0.127	0.089	0.038	0.000	0.089
Jul	0.256	0.109	0.159	0.084	0.036	0.000	0.084
Aug	0.225	0.066	0.110	0.081	0.035	0.000	0.081
Sep	0.210	0.057	0.104	0.081	0.035	0.000	0.081

In order to maintain the present day flow downstream of the Buffelspoort Dam up to EWR 6 site, the operating rule that has been applied by DWS to release water to irrigators downstream of the dam must remain in force. This entails the release of 16 million m^3 per annum if the dam is at 50% of its full supply capacity (FSC) and 5 million m^3 if the storage drops to below the 50% FSC. It should be noted that water from the Buffelspoort Dam is fully allocated. Several agricultural water users had been identified located within close proximity to the project area. These water users are dependent on water supply from the Buffelspoort Dam Water Scheme although some of the water allocations had been transferred to the mining sector. A desktop study based on the SANBI and National Freshwater Ecosystem Priority Area (NFEPA) database as illustrated in Figure 9 has revealed no wetlands in the immediate vicinity of the Elandsdrift area. Water supply and demand for the area is addressed through the Rand Water Board (RWB) supply scheme. Water to the proposed mining will also be obtained as is currently the case for the underground mine of Elandsdrift from RWB pipeline and piped for 3.1 km to the mine site. Although the Buffelspoort Dam is located in close proximity to the mine, there are no further allocations available from this water resource.

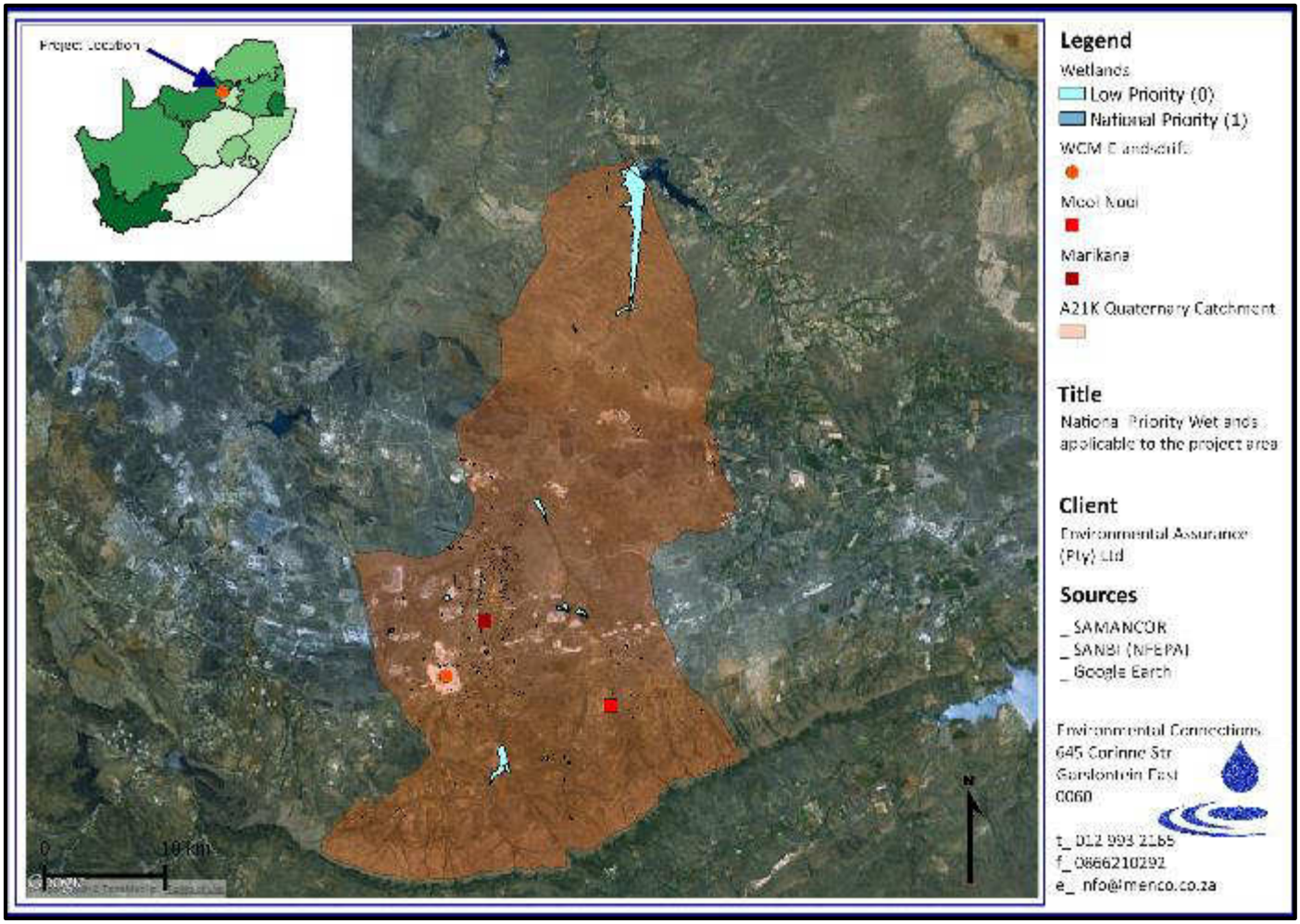


Figure 9: Wetland delineation based on NFEPA (Mare, 2013)

6.1.7 Flora

Reference is made to the Vegetation Assessment attached to the Ecological Impact Assessment (Annexure 3.4).

Five vegetation study units were identified on the study site and are presented in Figure 10. The soil on the western half of the study site was deep turf with natural *Acacia - Dichrostachys* thornveld vegetation on the north-western quadrant of the study site. The habitat on this part of the site was suitable for *Stenostelma umbelluliferum,* a very small milkweed species which is classified as a near threatened species. Although *Stenostelma umbelluliferum* was not found during the survey, mining activities might impact on their presence, should they occur in this study unit. A number of Marula trees (*Sclerocarya birrea* subsp *caffra*) were found in the north-western quadrant of the site (*Acacia - Dichrostachys* thornveld). The Marula trees on the north-western quadrant of the site

recorded in the *Acacia - Dichrostachys* thornveld are protected trees in terms of section 15(1) of the National Forests Act of 1998, and should be preserved *in situ*. A suitably qualified person should identify and mark the trees and a suitable buffer that will ensure persistence of the trees, taking into account the depth of the proposed excavations, should be allowed around each Marula tree. If these protected trees cannot be preserved then a permit should be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) to change their status. An outcrop of rocks designated *Combretum – Berchemia* outcrop, covered with dense trees and shrubs occurred along the northern boundary line in the centre of the site within the 200 meter extended area (Mamba Kop). Because of its pristine nature and high species diversity, the *Combretum – Berchemia* outcrop study unit should be considered sensitive and mining activities might impact on the study unit.

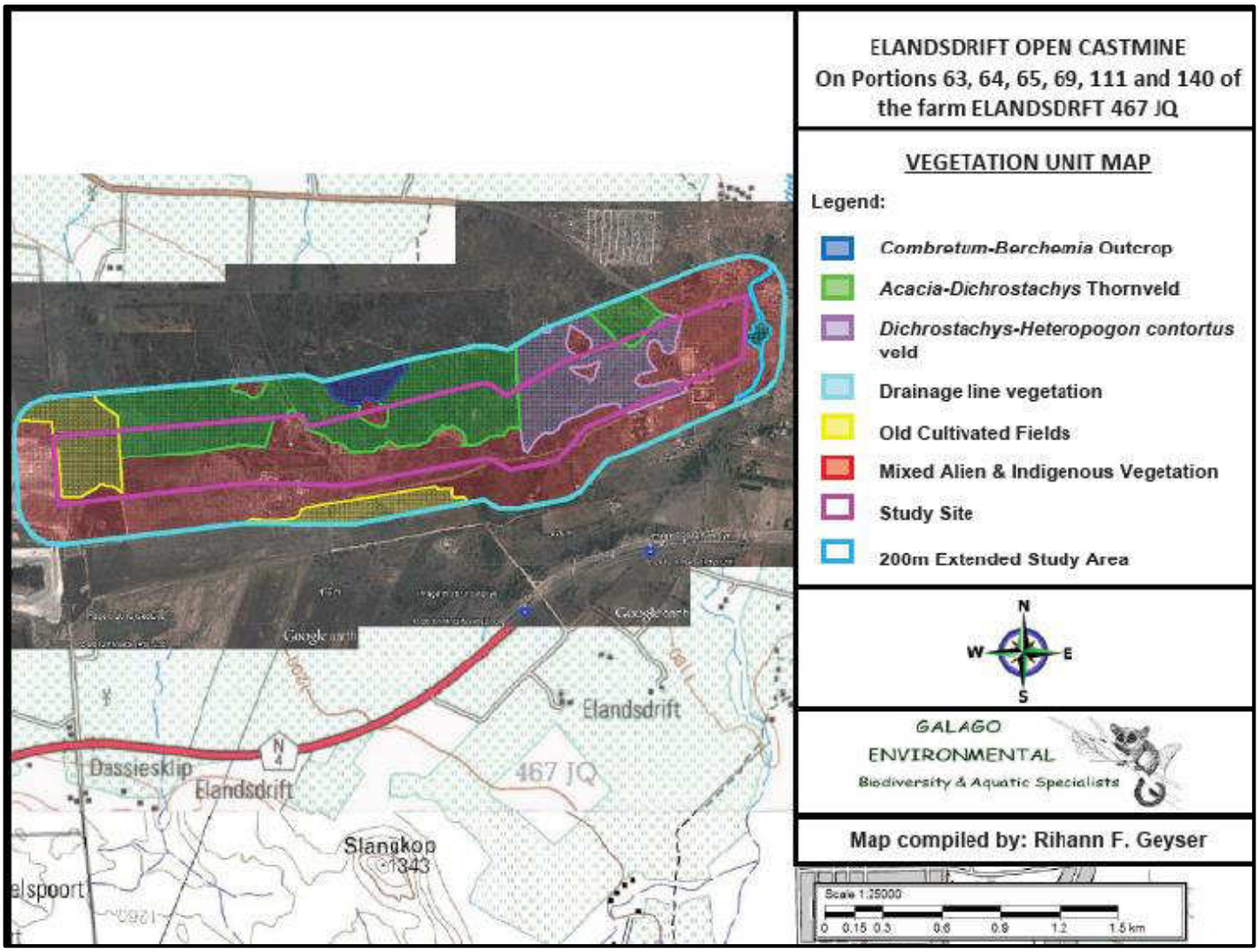


Figure 10: Vegetation units (Marais, 2012)

6.1.8 Fauna

Reference is made to the Mammal Habitat Assessment attached to the Ecological Assessment (Annexure 3.4).

Table 20, Table 21 and Table 23 lists the possible presence or absence of threatened mammal species, near threatened mammal species and data deficiency, respectively, at the site. Because the site falls outside reserves, threatened species such as the black rhinoceros (*Diceros bicornis*) and the African wild dog (*Lycaon pictus*) are obviously not present. No small mammals of particular high conservation significance are likely to be found on the site. There appears to be no threat to any mammalian species which are of particular high conservation priority or which are threatened, if the study site is developed. Large mammals such as elephant, lion, buffalo and rhinoceros species that occurred historically at the site are obviously absent from the area, owing to anthropogenic impacts in recent centuries. This loss of large species means that the mammal diversity at the site is far from its original natural state not only in terms of species richness but also with regards to functional roles in the ecosystem. Smaller antelope such as

duiker, *Sylvicapra grimmia* is still present at the site. No mammalian species, particularly adapted to wetlands are likely to be resident at the site. Mammalian species which favours rocky habitats, such as *Elephantulus myurus* (Eastern rock elephant-shrew) and *Pronolagus randensis* (Jameson's red rock rabbit) may occur at the site though the rocky hill is rather isolated. Higher mammal diversity is expected at the rocky hill that enters the northern parts of the site, though this hill is rather isolated in the larger area and surrounded by a landscape which has been transformed or disturbed to a large extent.

Table 18: Threatened mammal species of the North West Province (Marais, 2012)

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment
Chrysospalax villosus Rough-haired golden mole	Vulnerable	No	No
Cloeotis percivali Short-eared Trident Bat	Vulnerable/ Near-threatened	No	No
Diceros bicornis Black rhinoceros	Critically Endangered	No	No
Lycaon pictus African wild dog	Endangered	No	No
Loxodonta africana African elephant	Vulnerable	No	No
Mystromys albicaudatus White-tailed mouse	Endangered	No	No
Neamblysomus julianae Juliana's Golden Mole	Critically Endangered	No	No
Panthera leo Lion	Vulnerable	No	No
Rhinolophus blasii Blasi's Horseshoe Bat	Vulnerable	No	No

Table 19: Near Threatened mammal species of the Gauteng Province (Marais, 2012).

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment
Ceratotherium simum White Rhinoceros	Near-threatened	No	No
Manis temminckii Ground Pangolin	Lower risk/ Near threatened	No	No

Table 20: Data deficient mammal species of the Gauteng Province (Marais, 2012).

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment
Myosorex varius Forest shrew	Uncertain	No	No

Reference is made to the Avifauna Habitat Assessment attached to the Ecological Impact Assessment (Annexure 3.4).

The major habitat systems identified as likely to be used by bird species expected to occur on the study site are presented in Figure 11. Three major avifaunal habitat systems were identified. A short description of each habitat type follows, ranked from most to least important:

Acacia Savanna and mixed broadleaf

42 % (± 254.873 ha) of the study site and 500m extended study area consists of *Acacia* savanna vegetation. The open grassland systems on the study site forms part of the Marikana thornveld vegetation type and can be described as open savanna grassland with scattered trees and shrubs. The woodland vegetation varies in density from place to place from isolated scattered trees surrounded by savanna grassland to areas with dense almost impenetrable woodland dominated by thorny trees such as *Dichrostachys cinerea.* Mixed *Acacia* and Broadleaf woodland can be found on the slopes of the rocky outcrops on the study site. Some woodland areas especially in the southern portion of the study area are disturbed.

This habitat will favour avifaunal species typically associated with open savanna and dense woodland habitat and more specifically mixed broadleaf and *Acacia* woodland. This area generally include a great variety of arboreal passerines such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers and arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. *Acacia* trees generally attract many insects and in turn a good diversity of typical "Bushveld" bird species. Fallow fields or old cultivated fields, which constitute 20% (±120.621 ha) of the study site are also present but are mostly restricted within the 500m extended study area. Most of these areas are overgrown by grasses and weeds. For purposes of the vegetation study the fallow fields were grouped together with the Acacia savanna and broadleaf vegetation for this habitat description since the species diversity will not differ significantly from the savanna grassland. The presence and abundance of bird species in this habitat will vary from season to season - lush and green in summer after summer rains and dry, brown, frosted or burnt during winter. The habitat favours ground-living bird species, such as lapwings, francolins, pipits, longclaws, larks and chats. These birds hunt for insects and/or breed on the ground, in burrows or between the grasses. Weavers and widowbirds make use of this habitat for feeding on ripe seeds during late summer and early winter when the grass is not burnt while widowbirds and cisticolas will also breed in the tall grass during summer. Species such as weavers and bishops that breed in the surrounding wetland habitat during summer will also make use of this habitat for feeding during winter after the grasses have seeded. Aerial feeding birds such as martins, swifts and swallows will also hunt for insects over the grasslands.

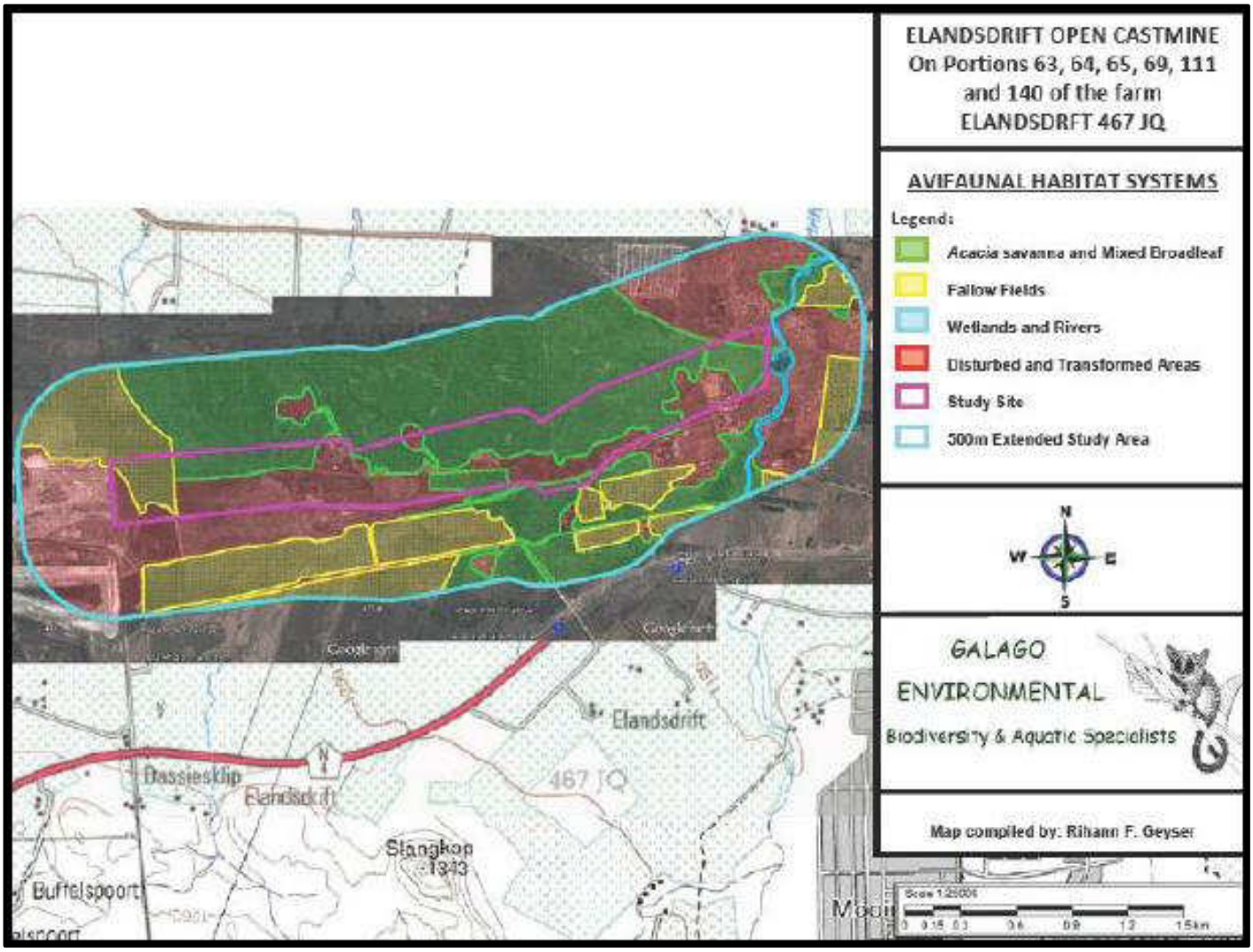


Figure 11: Avifaunal systems (Marais, 2012)

Wetlands and Non-perennial river systems

0.5% (±3.313 ha) of the study site consists of wetlands and river and riparian vegetation. Wetlands are very limited within the boundaries of the study site. Permanent wetland areas are mainly limited to manmade wetlands and small water filled quarries. True wetlands are situated just outside the boundaries of the study site and consists of dry drainage lines and non-perennial river systems represented by the Elandsdriftspruit that run just outside the eastern boundary of the study site. Except for taller grasses and weeds that grow within the drainage line the vegetation within the drainage line does not differ significantly from the surrounding savanna in terms of avifaunal habitat and the avifaunal species diversity will not differ significantly from each other. The non-perennial river consists of an open river system with little riparian vegetation. The small river has cut deep into the landscape over years and the river is shallow and narrow with deeper man-made dams constructed in its path. The more common avifaunal species associated with wetlands and rivers are likely to make use of the aquatic and semi-aquatic vegetation that grow within its waters and on its banks.

Disturbed and Transformed Areas

37% (±3.313ha) on and within the 500m extended study area has already been disturbed and transformed by past and present mining activities and a lot of exotic and alien vegetation has invaded most of these areas. The areas consist of mine dumps that are not vegetated or areas that have been partly stabilised with mainly exotic and invasive vegetation. The disturbed and transformed areas also include roads, buildings and quarries. Only the more common avifaunal species that are able to adapt to areas changed by man are likely to occur within this area.

Observed and Expected Species Richness

Of the 185 bird species recorded for the 2527DA q.d.g.c., 157 (84.8 %) are likely to occur on the study site and 53 (33.7 %) of these bird species were actually observed on and within the 500m extended study area. In addition 7 species were observed on the study site and within the 500m extended study area that was not recorded for the 2527DA q.d.g.c. during the period of the SABAP1 project. Thus a total of 164 avifaunal species was seen or are likely to occur on the study site. The Avifaunal Biodiversity Index (ABI) indicates that the largest bird species diversity is likely to occur within the *Acacia* savanna and fallow fields vegetation habitat system on and within 500m surrounding the study site, with an avifauna biodiversity index (ABI) of 580, followed by the wetland, river and riparian vegetation (ABI 461) and the disturbed and transformed areas (ABI 251). These comprise the 164 species actually observed on or that are likely to occur within the specific habitat systems on and within 500m surrounding the study site. This does not include overflying birds or rare vagrants. The reporting rate for each species is the percentage for the q.d.g.c. according to the SABAP 1 atlas. The habitat preference scores for each species are shown under the recognised habitat types on site: AF = Acacia savannah and fallow fields, WR = Wetland and River and Riparian vegetation and DT = Disturbed and Transformed Areas, with their possibility of occurrence in these specific habitats rated as 5 = present, 4 = High, 3 = Medium, 2 = Low, 1 = Very low, and 0 = Not likely to occur.

Threatened and Red Listed Bird Species

The following Red Data avifaunal species were recorded for the 2527DA q.d.g.c. according the SABAP1 data and the current SABAP2 data for the 2527DA q.d.g.c. and more specifically the 2540_2730 pentad (Table 15).

Table 21: Red data bird species

Red Data bird species recorded for the 2527DA q.d.g.c. SCIENTIFIC NAMES	**COMMON NAMES**	**Reporting Rate (%)***		
		SABAP1	**SABAP2**	**Pentad**
Tyto capensis	African Grass-Owl (**VU**)	**5**	0	0
Rostratula benghalensis	Greater Painted-snipe (**NT**)	**0**	**1.3**	0
Pterocles gutturalis	Yellow-throated Sandgrouse (**NT**)	**0**	**2.6**	0
Gyps africanus	White-backed Vulture (**VU**)	**5**	0	0
Gyps coprotheres	Cape Vulture (**VU**)(**END**)	**18**	**2.6**	0
Falco naumanni	Lesser Kestrel (VU)	**0**	**1.3**	0
Falco biarmicus	**Lanner Falcon (NT)**	**5**	**2.6**	**12.5**
Ciconia nigra	Black Stork (NT)	**9**	0	0
Buphagus erythrorhynchus	Red-billed Oxpecker (NT)	**0**	**1.3**	0
TOTAL:		**5**	**6**	**1**

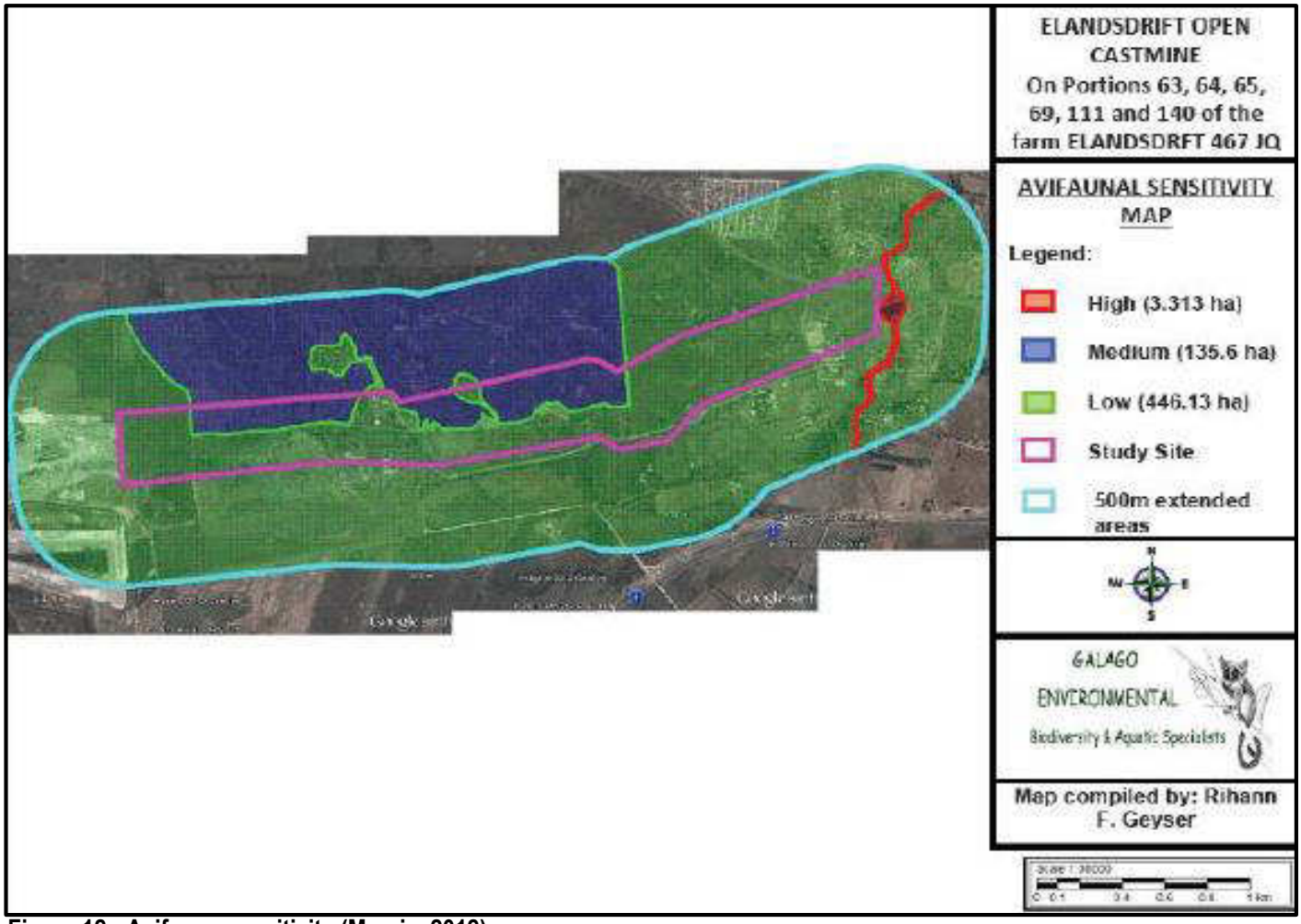


Figure 12: Avifauna sensitivity (Marais, 2012)

Reference is made to the Herpetofauna Habitat Assessment attached to the Ecological Assessment (Annexure 3.4).

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. All four habitat types for herpetofauna, namely terrestrial, arboreal, rupiculous and wetland-associated vegetation cover were present. Therefore, it was possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges. The terrestrial habitat comprises of *Dichrostachys–Heteropogon contortus* veld and old cultivated fields. Superficially, the terrestrial habitat appeared to be in good condition. However, during the autumn site visit the grass cover was high and dense. This was considered a suitable locality for providing abundant refuge to terrestrial herpetofauna. The grassland has been used for livestock grazing for decades and is, at present, still being used for this purpose. Only a few termitaria were observed on the eastern part of the study site, but moribund termitaria, which normally provide ideal retreats for small reptiles and amphibians, were absent from the study site. The western half of the study site, with its deep turf soil, provides natural thornveld vegetation, which is excellent habitat for arboreal herpetofauna. Sickle bush (*Dichrostachys cinerea subsp africana*) has invaded large areas and Marula trees (*Sclerocarya birrea subsp caffra*) were frequently observed within the study site.

Connectivity with natural vegetation exists to the north and east but is limited by roads and old cultivated fields. An outcrop of rocks (Mamba Kop), covered with dense trees and shrubs, which also provides habitat for arboreal reptiles, occurs along the northern boundary line in the centre of the site. Dead logs, which provide some habitat for small herpetofauna, also occur on the study site. The rocky Mamba Kop and the ruin of an old homestead provides good rupiculous habitat for herpetofaunal species. Near the ruin of the old homestead was a shallow temporary man-made dam, which provides an excellent breeding area for frog. Towards the west of the study site, near the large mound of soil on a cleared area with tamarisk trees (*Tamarix ramosissima*) and fountain grass

(*Pennisetum setaceum*), is a cement wall in a small drainage line, which also provides habitat for frogs and water-dependent reptiles. The Elandsdriftspruit drainage line runs east of, and outside the boundaries of the study site, but is very important. The Elandsdriftspruit drainage line is a distribution corridor for many water-dependent herpetofauna, which may also forage on the study site.

Of the 56 reptile species which may occur on the study site, five were confirmed during the site visit and of the possible 21 amphibian species which may occur on the study site; one was confirmed during the site visit. The 77 herpetofaunal species were recorded as potential occupants of the study site. Most of these herpetofaunal species are robust generalists with the ability to capitalise on disturbed environments. It should be noted that potential occurrence was interpreted as being possible to persist over a period of time, as a result of expansions and contractions of population densities and ranges which stimulate migration. The American red-eared terrapin (*Trachemys scripta elegans*) is the only feral reptile or amphibian that has been known to occur in South Africa, but with only a few populations, it is not expected to occur on this particular site. The species assemblage is typical of what can be expected in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity are fairly common and widespread (viz. brown house snake, mole snake, common egg eater, Mozambique spitting Cobra, eastern striped skink, guttural toad, raucous toad and red toad). The relatively high species richness is due to the fair size of the study site and the four different habitat types occurring on the study site.

The study site falls inside the natural range of the Southern African python. Southern African pythons favour moist, rocky, well-wooded valleys, plantations or bush country, but seldom if ever stray far from permanent water. The study site thus provides suitable habitat for the Southern African python, but the study site is too small to support a viable population. It is often estimated that a single python needs at least 100ha area to forage. The striped harlequin snake has not been recorded on this quarter degree square (Ditsong Museum of Natural History or TVL Museum Records), and no moribund termitaria, where this snake species is most likely to be found, are present on the study site. It is very difficult to confirm whether this cryptic snake is present on any study site, but this snake species should not occur on the study site. The study site falls outside the natural range of the Nile crocodile and it does not occur on the study site. There is a man-made temporary water body, where bullfrogs are most likely to breed, on the study site. Bullfrogs prefer these temporary pans in order to avoid predation from fish, and for tadpoles to swim in schools and stay in the warm, shallow water during the day for rapid development.

Some of the terrain around the man-made temporary water body is gravel and the soil on the western half of the study site is deep turf. Despite this, there are sandy red soil areas to the east of the man-made temporary water body that are very suitable as a dispersal area, which combines feeding and aestivation. It is essential that the soil should be suitable for burrowing on a daily basis during the short activity period at the beginning of the rainy season and for deeper retreats during the resting periods. According to the *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland* the habitat of giant bullfrogs and their population sizes have declined by more than 50% over the past 100 years due to extensive crop agriculture and/or urban and industrial development, which include the North West Province. It is important to note that the giant bullfrog's status has changed officially from Near Threatened to Least Concern in South Africa. The proposed development of opencast mining will inevitably transform large areas of natural habitat. Keeping the footprint of all activities as small as possible will be the initial focus for conservation and mitigation action, followed by the best possible practices for the rehabilitation of the disturbed areas once mining has been completed.

Considering the scale of the proposed mining activities, the loss/displacement of some fauna is a foregone conclusion, particularly that of terrestrial species, but in the overall picture of the affected species, it will be minimal. However, maintaining (and even improving) the conservation integrity of the Elandsdriftspruit is imperative and non-negotiable. This water source should be regarded as sensitive, as such providing indispensable habitat for Red Listed and sensitive species as well as serving in places as a dispersal corridor. This implies a buffer zone of 100 metres from the edge of the riparian zone (as prescribed for areas outside the urban edge) for the Elandsdriftspruit. From a herpetological viewpoint the buffer zone should benefit mainly the wetland-associated amphibians and reptiles. This will create many suitable habitats for water–dependent herpetofauna within the study site and this may even improve the quality of the protected habitats. If the mining activities should go ahead, an important indirect effect would be the likely impact that the mining might have on the surface water runoff and water quality of the Elandsdriftspruit catchment area.

This could have a negative impact on the herpetofauna. The effects could be ameliorated by the construction of retention ponds, which would retard discharge into the catchment area and improve the discharge water quality. Because of its pristine nature and high species diversity, Mamba Kop should be excluded from mining activities. There is a marginal possibility that the contentious Red Data Giant Bullfrog may occur on the study site.

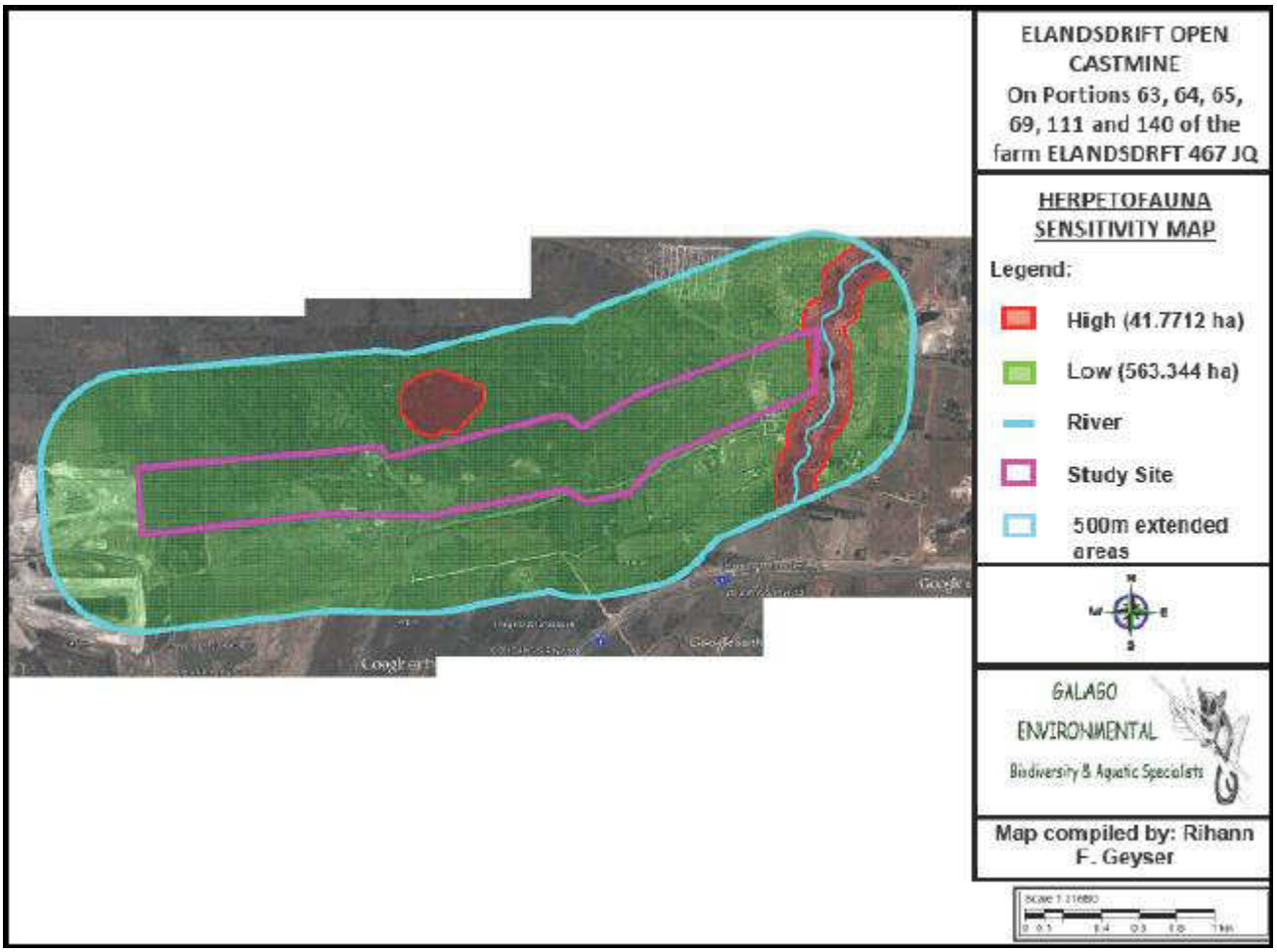


Figure 13: Herpetofauna sensitivity

6.2 Socio-economic environment

Reference is made to the Social Impact Assessment attached in Annexure 3.6.

6.2.1 Socio-economic profile

District level

The Elandsdrift Chrome mine at a district level is located within the Bojanala District Municipality, at the local municipality level the Mine falls under the jurisdiction of the Madibeng Local Municipality located in North West province. The North West Province is regarded as the sixth largest populated province with 3.4 million residents (8.3% of the national population). Approximately 35% of the people in the province are urban dwellers and 65% live in rural areas. Of the 3.4 million people in the province, 6.6% are whites, 1.4% coloureds, 0.3% Indians and 76.7% are Africans. Just over 50% of the people in the province are female which is consistent with national figures. It is estimated that almost 35% of the total adult population can be regarded as illiterate. The North West Province's economy is derived from a variety of sectors, of which mining and agriculture are the main contributors. The mining sector is the lead contributor to the Province's economy (35.5% contribution to the domestic economy in 1996). Approximately 118 000 formal employment opportunities are provided by the mining sector (22% of total employment available in the province).

Bojanala District Municipality makes up 38.7% of the North West Province's total population. The unemployment rate in the district has increased over the period 1996 to 2003 from 140 000 to 271 000 (Mlanda, 2014).

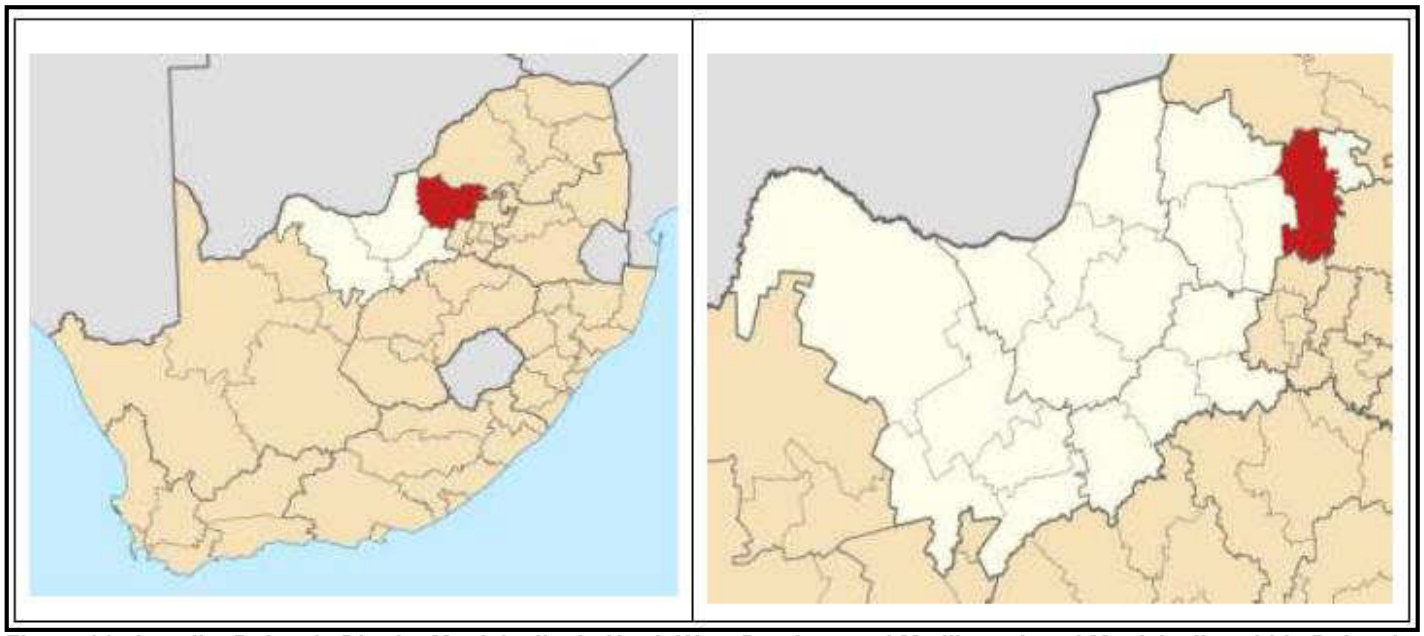


Figure 14: Locality Bojanala District Municipality in North West Province and Madibeng Local Municipality within Bojanala District Municipality

Local level

The Madibeng Local Municipality (MLM) covers an area of 3,839 km², and is mainly rural in nature. Urban and mining activities account for ~5% of land uses in the area. Land use activities are concentrated in the southern portion of the MLM. The majority of the MLM is covered by open bush and sparse or secondary bush land, specifically in the centre and the north (Mlanda, 2014).

6.2.2 Population Demographics

District

Bojanala District has a population of 1 507 505. In terms of Age Structure the population Under 15 years of age forms 26.40% of the total population size. The majority of people in area are within the age group15 to 64 years and they form 68.30% of the total population size. As is common to South Africa the population over 65 years is relatively small and forms only 5.30% of the total population (Mlanda, 2014).

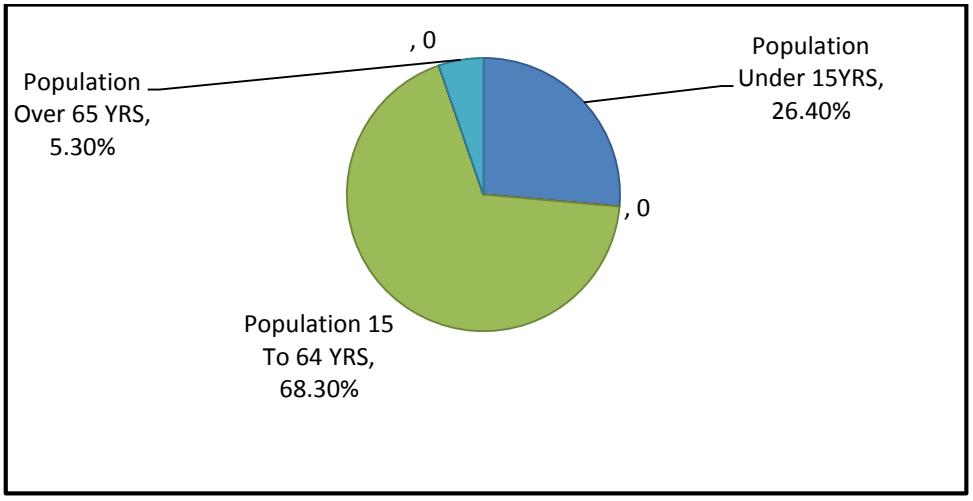


Figure 15: Population Distribution

The population pyramid shows that the district has consistently been having a higher number of young adults aged between 20 and 24 to any other age bracket after the year 2006. The males within this age bracket make up the highest number of the population at a value of 72 743 and females at 58 860. At the top of the pyramid it indicates that more females than males reach the senior citizens bracket. Past the age of 59, there are now either an equal or more number of females to males in the district (Mlanda, 2014).

Local level

The Madibeng Local Municipality population has increased significantly in the decade between the two Censuses, namely by 129 803 people (Figure 23). Household sizes decreased slightly, by 0.5 per household, partially contributing to the increase of 64 799 households in the MLM over the period. The skew towards males over females has increased by 8.5% (Mlanda, 2014).

Changes with regard to socio-economic development indicators such as female headed households (-5%), dependency ratios (-5.2%), unemployment (-11.5%), youth unemployment (-14.7%) and education are all positive. Virtually 70% of the MLM population is of economically active age (Mlanda, 2014).

Table 22: Key demographic indicators for the Madibeng Local Municipality (Mlanda, 2014)

ASPECT	2001	2011	CHANGE (%)
Population	347 578	477 381	+3.7% p.a.
Households	95 924	160 723	-
Household size (average)	3.4	2.9	- 0.5
% Female headed households	35.3	30.3	- 5
Sex Ratio (males per 100 females)	105.2	113.7	+ 8.5
Dependency ratio per 100 (15-64)	49.6	44.4	- 5.2
% Population <15 years	26.3	25.7	- 0.6
% Population 15-64	68.8	69.2	+ 0.4
% Population 65+	4.9	5.1	+ 0.2
Unemployment rate (official) - % of economically active population	41.9	30.4	- 11.5
Youth unemployment rate (official) - % of economically active population 15-34	52.9	38.2	- 14.7
No schooling - % of population 20+	15.6	7.8	- 7.8
Higher Education - % of population 20+	5.6	7.7	+ 2.1
Matric - % of population 20+	20.4	27.3	+ 6.9

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

6.2.3 Education

District level

The area shows moderate figures of illiteracy. Only 6.86% of the population has had no schooling and in total 19.51% of the population over the age 15 can be regarded as functionally illiterate (Mlanda, 2014).

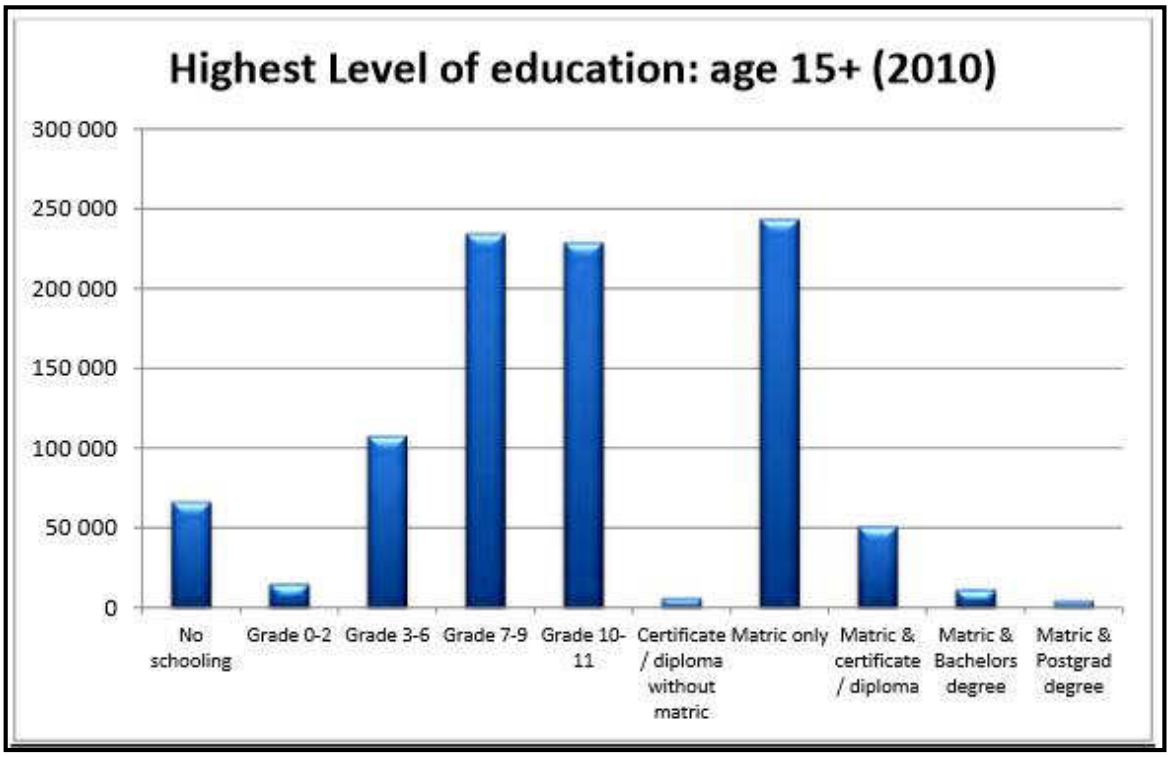


Figure 16: Highest educational levels in Bojanala District Municipality (Mlanda, 2014)

The education status of the population older than 15 years of age indicates that the literacy levels have been increasing in the district. There are visible results of the initiatives such as the Adult Based Education Centres and FET Colleges. The district's functional literacy level in 2010 was 73.8%. The labour market would now be characterised by individuals with literacy, language, and basic trade skills although most would have no experience or official registration to the trade. The district however still lacks a lot of professionals. It is only 0.46% of the population that holds a postgraduate qualification. This could influence the economic activities that people would be able to undertake at Elandsdrift Mine, which in this case are mainly elementary occupations (example general workers, mine workers, cleaners etc.) [Mlanda, 2014].

Local level

Madibeng Local Municipality has a relatively low level of illiteracy, with only 18% of over 20 year olds indicating that they had not received any schooling at all. 64% of the over 20 year old population indicated that they had been educated up to matric level (Mlanda, 2014).

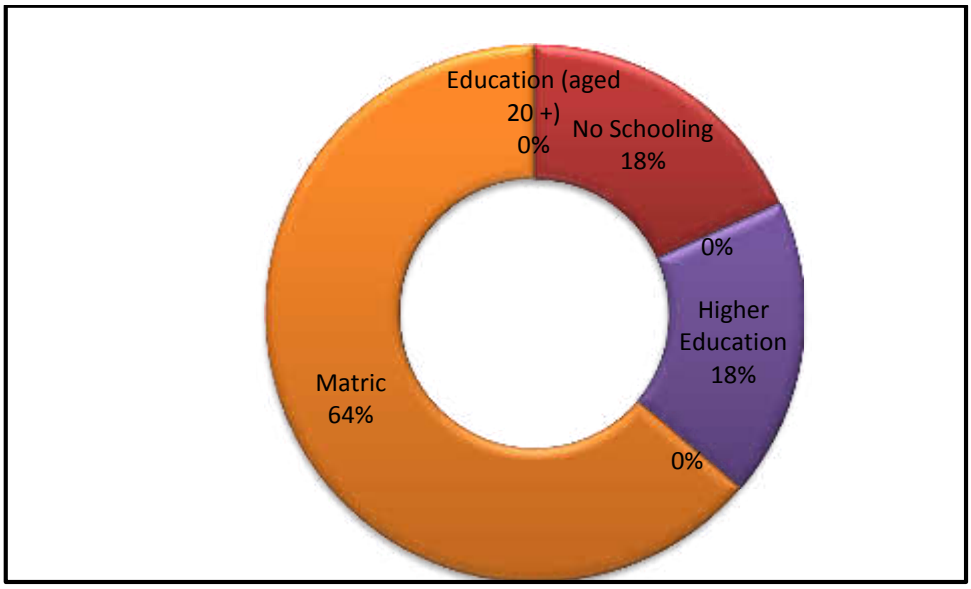


Figure 17: Educational levels in Madibeng

6.2.4 Income and employment

District level

The district has relatively poor income levels as much as 13.29% of the households in the district have a less than R18 000 annual income which amounts to R1 500 per month. On the high income bracket only 7% of the households earn greater than R350 000 per annum (Mlanda, 2014).

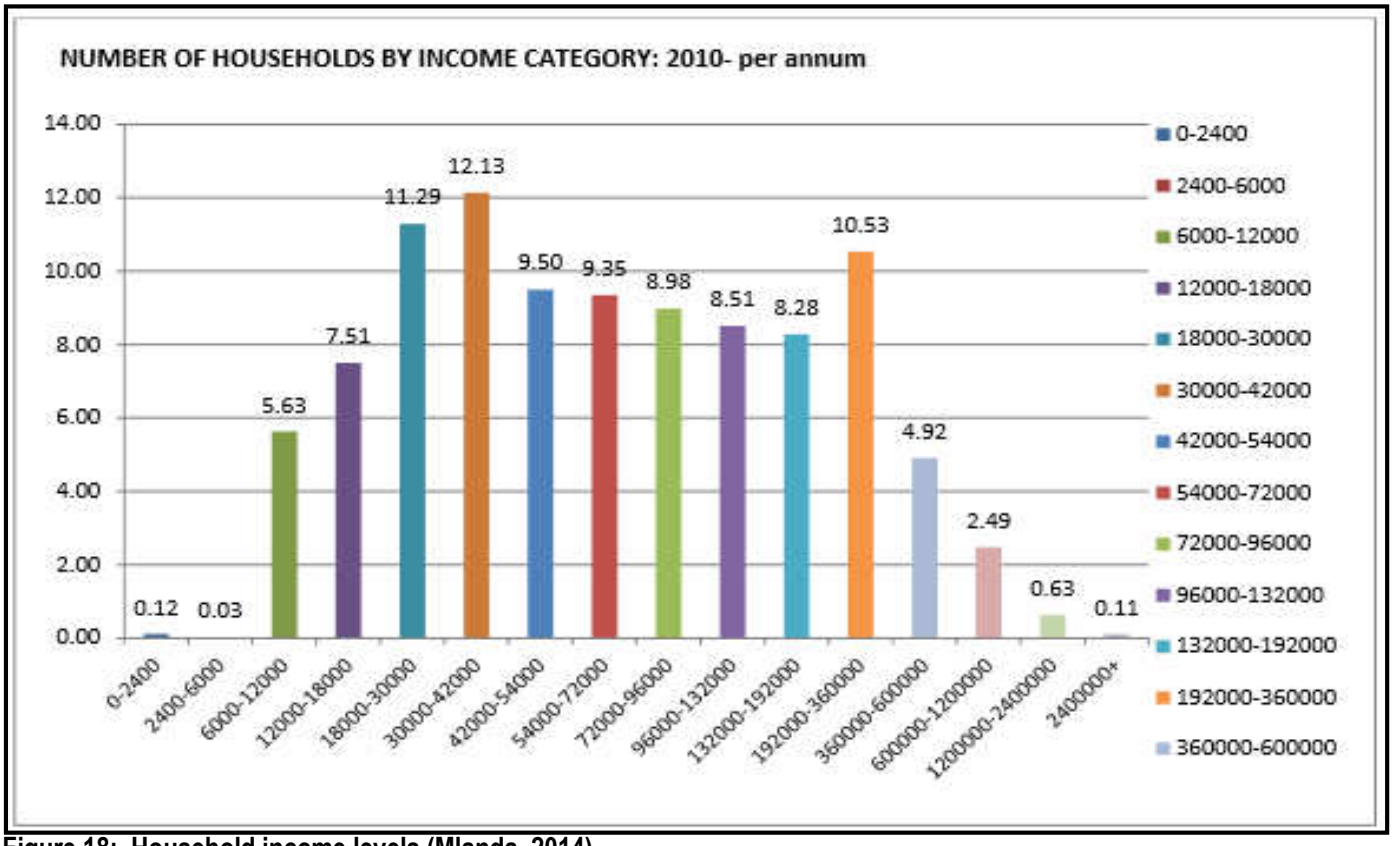


Figure 18: Household income levels (Mlanda, 2014)

The estimated unemployment rate for the district is approximately 14.6%. The decline to 14% is a reflection of:

- The impact of 2009 Confederations Cup and the 2010 FIFA World Cup;
- The availability of credit, and mines opening new shafts or upscaling production that was laid down in the Recession period of 2008/09 (Mlanda, 2014).

Mining and agriculture are the major land uses in the district where Elandsdrift is located. These two sectors play a prominent role in the District's economy with mining being the key contributor to the production of electricity and the manufacturing of chemical and petrochemical products. Using data from the community survey of 2007 carried out by Statistics South Africa the assessment practitioner cross tabulated the employment levels in these two sectors so as to generate a comparative chart on the sector providing the largest volume of employment (Mlanda, 2014).

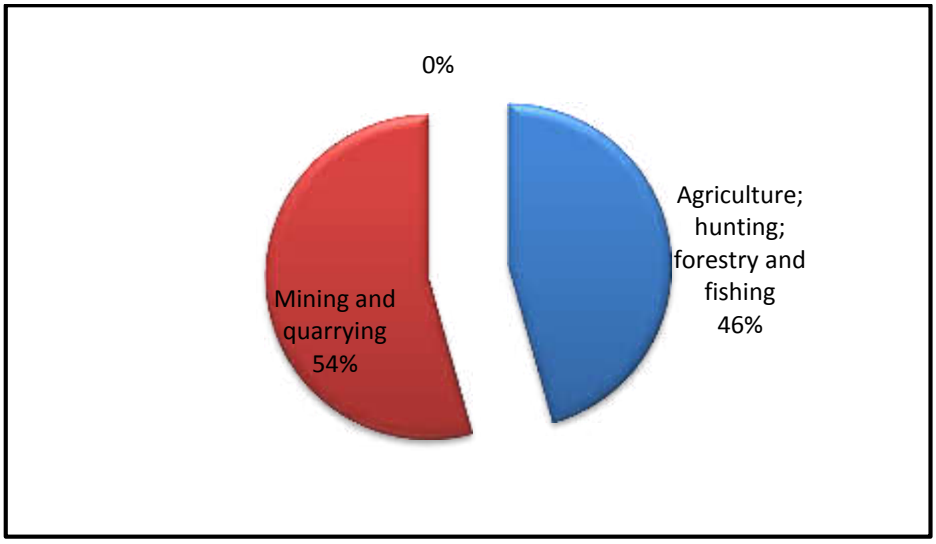


Figure 19: Community survey 2007 Employment by sector cross tabulation of Elandsdrift Mine surrounding land uses (Mlanda, 2014)

Local level

The employment figures and unemployment figures in the local municipality are similar to those observed at the district level. In 2011 the average unemployment rate was approximately 27%. Whilst the employment rate stood at 35%, the rest of the population was in the economically inactive category, which stood at a figure of 38% (Mlanda, 2014).

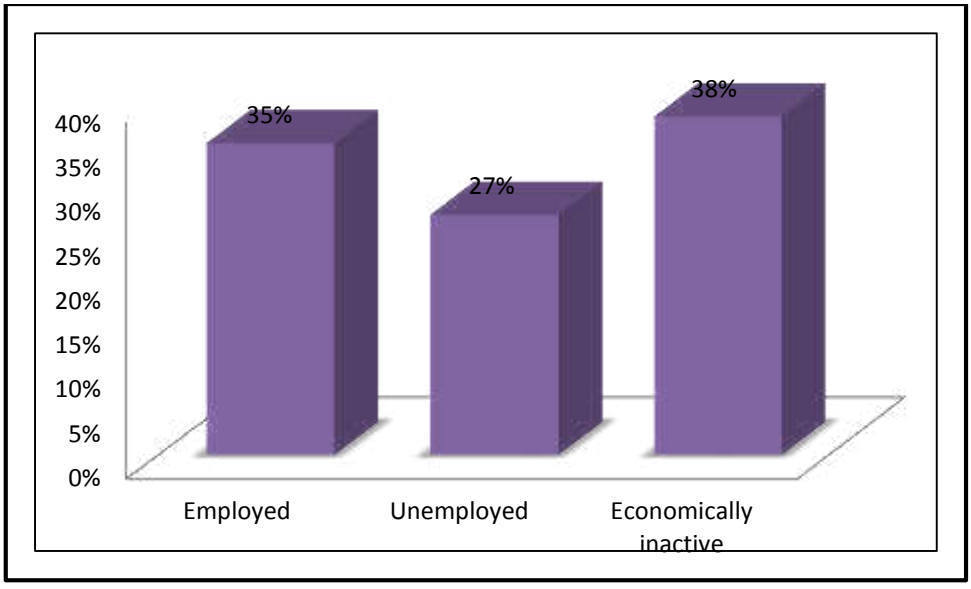


Figure 20: Employment levels within Madibeng Local Municipality (Mlanda, 2014)

An overwhelming majority of the employed population were working within the primary sector of agriculture and mining. This trend is also a reflection of the trend observed at the district municipality level. The average monthly household income stood in the region of R800. Followed by an overwhelming number of people indicating that they had no source of income, this could perhaps be directly related to the fact that the area has a high level of economically inactive people (Mlanda, 2014).

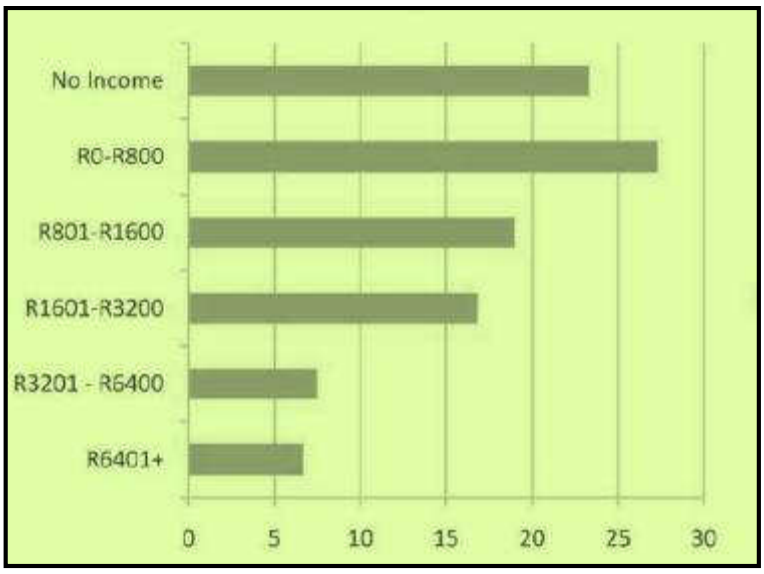


Figure 21: Monthly household income (Mlanda, 2014)

6.2.5 Heritage resources

Reference is made to the Phase 1 Heritage Impact Assessment attached in Annexure 3.7.

During the survey one site of cultural heritage significance was located in the area to be developed. It is a grave yard belonging to the Historical Age. However, there is always a possibility that more sites may become known later and that those need to be dealt with in accordance with the legislation discussed above. In order to enable the reader to better understand archaeological and cultural features, it is necessary to give a background regarding the different phases of human history (Van Vollenhoven, 2012).

Stone Age

The Stone Age is the period in human history when lithic material was mainly used to produce tools. In South Africa the Stone Age can be divided in three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. The division for the Stone Age is as follows:

- Early Stone Age (ESA) 2 million – 150 000 years ago;
- Middle Stone Age (MSA) 150 000 – 30 000 years ago; and
- Late Stone Age (LSA) 40 000 years ago – 1850 - A.D (Van Vollenhoven, 2012).

The closest known Stone Age site in the vicinity of the surveyed area is a rock art site to the northeast. Rock engravings are found to the south and east of Rustenburg. These date back to the LSA. The environment is such that it does not provide much natural shelter such as caves and therefore it is possible that Stone Age people did not settle here for long periods of time. They would have however been lured to the area due to an abundance of wild life as the natural vegetation would have provided ample grazing and there are plenty natural water sources. One may therefore find small sites or occasional stone tools (Van Vollenhoven, 2012).

Iron Age

The Iron Age is the name given to the period of human history when metal was mainly used to produce metal artefacts. In South Africa it can be divided in two separate phases, namely:

- Early Iron Age (EIA) 200 – 1000 A.D.
- Late Iron Age (LIA) 1000 – 1850 A.D (Van Vollenhoven, 2012).

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

- EIA 250 – 900 A.D;
- MIA 900 – 1300 A.D; and
- LIA 1300 – 1840 A.D (Van Vollenhoven, 2012).

Many LIA sites have been identified in the area around the towns of Rustenburg, Koster and Groot Marico as well as in the Waterberg Mountains. This includes the surveyed area. During earlier times the area was inhabited by Tswana groups, namely the Fokeng and Hurutshe. In the 19th century and even today, the area is inhabited by other Tswana groups, namely the Kwena, Tlokwa, Phiring, Taung and the Fokeng. During the Difaquane these people moved further to the north and south, but they returned later on (Van Vollenhoven, 2012).

Historical Age

The historical age started with the first recorded oral histories in the area. It includes the moving into the area of people that were able to read and write. This era is sometimes called the Colonial era or the recent past. Due to factors such as population growth and a decrease in mortality rates, more people inhabited the country during the recent historical past. Therefore and because less time has passed, much more cultural heritage resources from this era have been left on the landscape. It is important to note that all cultural resources older than 60 years are potentially regarded as part of the heritage and that detailed studies are needed in order to determine whether these indeed have cultural significance. Factors to be considered include aesthetic, scientific, cultural and religious value of such resources. Early travellers have moved through this part of the Northwest Province (Van Vollenhoven, 2012).

Hume again moved through this area in 1830 followed by the expedition of Dr. Andrew Smith in 1835. Hume also moved through the area with Scoon in 1835. In 1836 William Cornwallis Harris visited the area. The well-known explorer Dr. David Livingston passed through this area in 1847. In 1837 the Voortrekkers also moved through the Swartruggens area. During this year a Voortrekker commando moved out against Mzilikazi and was engaged in a battle with his impi to the north of Swartruggens. The area surveyed was inhabited by white settlers as early as 1839. The greater Magaliesberg area saw much action during the Anglo-Boer War (1899-1902). British troops reached Rustenburg on 14 June 1900. Three battles were fought here during the War, being the one at Buffelspoort on 3 December 1900, the one at Nooitgedacht on 13 December 1900 and the one at Vlakfontein on 29 May 1901. The British also erected blockhouses in the area. Chances therefore are good to find sites associated with part of the human history. This might also include graves (Van Vollenhoven, 2012).

Table 23: Heritage resources (Van Vollenhoven, 2012)

	DESCRIPTION	LOCATION	EFFECT	PHOTO
Site 1	Site 1 is a large industrial site linked to the mining history of the area. It used to be the beneficiation plant. There are no building left, only ruins and even these are most likely not older than 60 years.	25°44.1415'S 27°31.333'E	Due to the age of the site it is regarded as having a low cultural significance. The site is of a general significance and is therefore given a rating of Grade CIVC. This report is seen as sufficient recording and it may therefore be demolished.	
Site 2	Site 2 consists of old mine buildings and a ground dam. These buildings are also not older than 60 years.	25°44.020'S 27°32.007'E	The site therefore has a low cultural significance. It receives a field rating of general significance, grade CIVC. It may therefore be demolished and this report is seen as ample mitigation.	
Site 3	This is a large LIA site consisting of extensive stone walling. Due to the dense vegetation it was not possible to determine the extent of the site, but it seems to be reasonably large.	25°43.934'S 27°31.203'E	It seems as if the development will have a direct impact on the site. Since the Iron Age forms an integral and important part of the past of Southern Africa, the site is important. However it is not very unique and is therefore given a medium importance. The field rating is local significance and the grading IIIB. It is therefore recommended that the site be mitigated by documenting it. This would include drawing of maps of the site in order to place it into a wider historical context and to thus preserve the information for scientific purposes. It may be demolished after mitigation.	

Site 4	This is another large LIA site consisting of extensive stone walling. Due to the dense vegetation it was not possible to determine the extent of the site, but it seems to be even larger than the previous one.	25°43.826'S 27°32.107'E	It seems as if the development will have a direct impact on the site. Since the Iron Age forms an integral and important part of the past of southern Africa, the site is important. However it is not very unique and is therefore given a medium importance. The field rating is local significance and the grading IIIB. It is therefore recommended that the site be mitigated by documenting it. This would include drawing of maps of the site in order to place it into a wider historical context and to thus preserve the information for scientific purposes. It may be demolished after mitigation.	
Site 5	Site 5 site consists of the ruin of an old building that most likely is linked to the farming history of the area. The site is most likely older than 60 years.	25˚44.053'S 27˚32.200'E	The site therefore has a medium cultural significance. It receives a field rating of general significance, grade BIVB. It may therefore be demolished, but should be mitigated first by recording it. This would include drawing a site map. The site however is inside of the buffer zone which means that direct impact is unlikely. This should be confirmed by the mine and if that is the case it may be left as it is, but be prevented from further deterioration.	
Site 6	This site consists of two old storage buildings, which are probably related to the farming history of the area. These buildings are more than likely older than 60 years.	25˚43.914'S 27˚32.418'E	They still seem to be in use and are not very unique. Many changes were also made to it recently. The site therefore has a low cultural significance. It receives a field rating of general significance, grade CIVC. It may therefore be demolished as there probably will be a direct impact on it. It may however be re-used. This report is seen as ample mitigation.	

Site 7	This site consists of the remains of buildings, which seem to have been a compound for the previous mining activities on site. These buildings are more than likely younger than 60 years.	25˚43.847'S 27˚32.638'E	The site is not very unique and therefore has a low cultural significance. It receives a field rating of general significance, grade CIVC. It may therefore be demolished.	
Site 8	This site consists of the foundations of an old stone building. It most likely is linked to the early mining history of the area as it is quite close to site no. 7. The site is therefore probably younger than 60 years.	25˚43.685'S 27˚32.657'E	The site falls within the area of direct impact, but has a low cultural significance. It receives a field rating of general significance, grade CIVC. It may therefore be demolished and no further action is necessary. This report is seen as ample mitigation.	
Site 9	This is an old magazine that probably contained explosives during an earlier mining era. The site is most likely younger than 60 years.	25˚43.890'S 27˚31.691'E	The site therefore has a medium cultural significance. It receives a field rating of general significance, grade BIVB. It however falls outside of the area of direct impact. It should therefore just be left as it is.	

Site 10	This again is a large LIA site on Mamba Kop. The density of the vegetation again made it impossible to determine the extent of the site.	25˚43.883'S 27˚31.716'E	It seems as if there will not be a direct impact on the site since it falls within the buffer zone. Since the Iron Age forms an integral and important part of the past of Southern Africa, the site is important. However it is not very unique and is therefore given a medium importance. The field rating is local significance and the grading IIIB. It is therefore recommended that the site be mitigated by documenting it. This would include drawing of maps of the site in order to place it into a wider historical context and to thus preserve the information for scientific purposes. The site should then be fenced in and a cultural heritage management plan be written in order to preserve it.	

6.2.6 Visual

Reference is made to the Visual Impact Assessment attached as Annexure 3.8.

Due to fact that topography modification has taken place by agricultural, vegetation and other mining activities, the view shed is only a theoretical study. For this assessment, viewpoints of sensitivity have been identified and then a visual inspection (photographic inspection) was conducted from these points to identify the severity of the visual impact of the activities. As indicated in Figure 22, three viewpoints were identified from where photographic inspections were conducted. The viewpoints have been identified based on the sensitivity of the areas to visual disturbance and areas that can be negatively impacted on by the mine related activities.

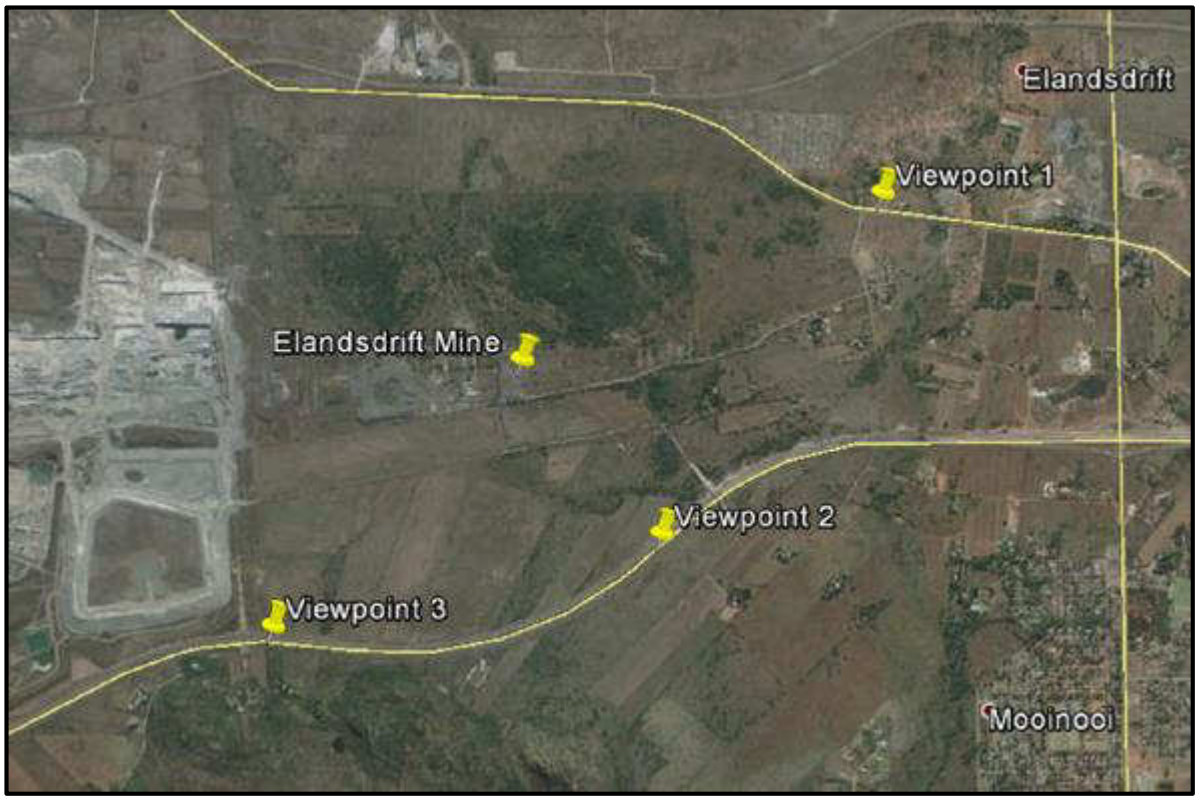


Figure 22: Viewpoints of the assessments

Viewpoint 1 is located on a gravel road east of the proposed development. Residents of the informal settlement and the old mining settlement use the road. This viewpoint represents the users of the road and the surrounding settlements located to the eastern side of the proposed development. Figure 23 is an indication of the visual exposure from the viewpoint. The visual exposure of the mine activities will be low on the road users; this is due to the short exposure time to the mine activities. The visual impact of the settlements will be medium to low. From viewpoint 1 the visual exposure will be minimal.

Viewpoint 2 is located southeast of the proposed development, on the N4 highway. This viewpoint represents the road users that will travel along the N4 highway and the town of Mooinooi some 3 km southeast of the proposed development. The visual exposure of the road users will be high but the duration and intensity of the exposure will be low due to the time the proposed development will be visible. The visual exposure of the town will be medium to low. The visual absorption capacity of the vegetation is very high, with high trees and shrubs acting as a visual block. The vegetation will reduce the intensity of the visual impact.

Viewpoint 3 is located southwest of the proposed development on the N4 Highway. This viewpoint represents the road users that will travel along the N4 Highway. Viewpoint 3 also includes the adjacent land users (i.e. adjacent settlements, other farmers and mine). The visual exposure of the road users will be high but the duration and intensity of the exposure will be low due to the time the proposed development will be visible. The surrounding land users will have a medium to low visual exposure and the visual impact will be medium.

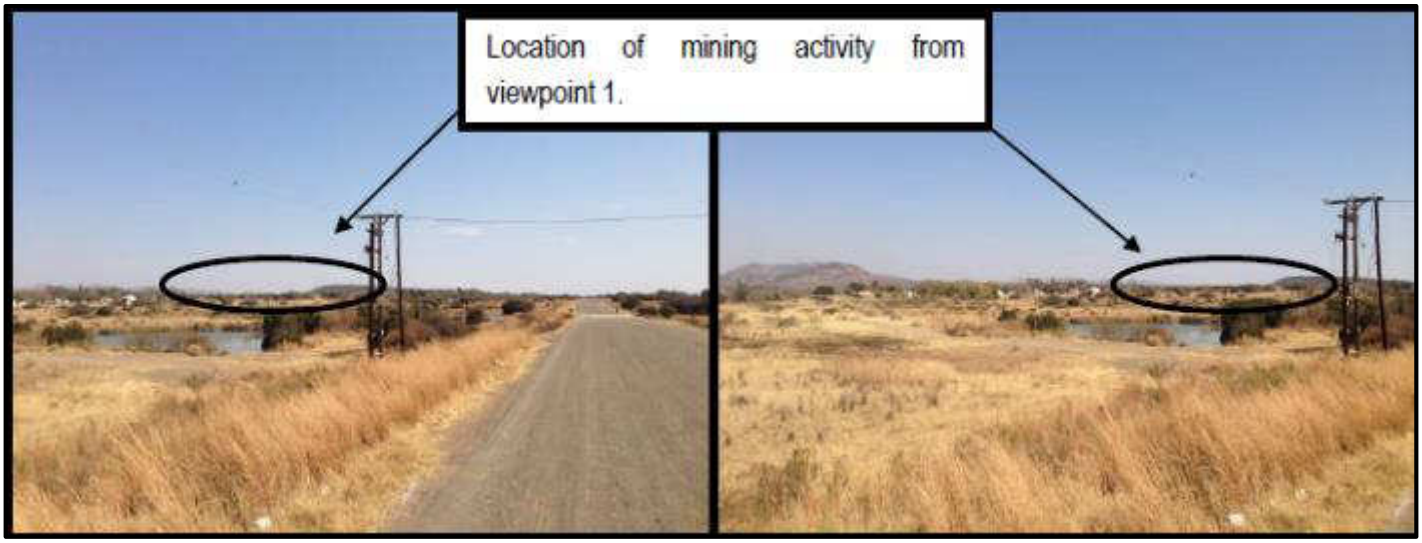


Figure 23: Visibility form viewpoint 1

Figure 24: Visibility from viewpoint 2

Figure 25: Visibility form viewpoint 3

6.2.7 Traffic

Reference is made to the Traffic Impact Assessment attached as Annexure 3.9.

The mine will be an extension of the existing Western Chrome Mine operations. Open pit mining will take place with a production of approximately 2400 tons per day. Of this, approximately 1200 tons will be lumpy and will be transported directly by road from the mine to the existing processing plant at the Western Chrome Mine facility. The remainder of the material, 1 200 tons per day, will be dispatched to customers to the N4 Highway, where after to various destinations. From a traffic impact point of view, trucks will therefore use two routes from the mine:

- To Western Chrome Mines (WCM) processing plant; and
- From the mine along Road D2170 to D314 and then northwards along Road D314 to the main entrance to Western Chrome mines. The approximate distances are as follows:

Mine access to Road D314 along Road D2170:	±1,3 km
Road D314 between Road D2170 and Western Chrome Mine access:	± 0,9 km
From Road D314 to WCM	± 1,5 km

To customers (to N4):
From the mine along Road D2170 to D314 and then southwards along Road D314 to the N4 interchange and then onto the N4. The approximate distances are as follows:

Mine access to Road D314 along Road D2170:	±1,3 km
Road D314 between Road D2170 and N4:	± 1 km

The mine is not a land use for which trip generation figures are available in the "SA Trip Data Manual". The mine's trip generation is normally not associated with the peak traffic hours on the adjacent road network due to the fact that the mine operates in shifts. It has, however, an admin component that works within normal weekday hours. From a trip generation point of view, the mine's peak trip generation occurs around shift change times and before and after the admin office hours. The trip generation will therefore be based on employment figures and operational information provided for this project. The following scenario has been utilised:

- Staff will increase from 248 in Year 1 to 1289 in Year 6; and
- There will also be 72 contractor's staff on site.

The mine will generate trips throughout the day, with the period during normal office hours generating, for instance, visitors, maintenance, general delivery etc. trips. This is difficult to quantify and the specialists normally use the equivalent of the trip generation of the two peak traffic hours as the basis for this purpose. The specialists normally allow for around 5% of these trips to occur during the peak periods of the admin trips. For the purposes of the report it is estimated at around 118 trips. This includes trucks that will deliver supplies to the mine.

The main areas from where labour can be employed and where personnel can reside are in Mooinooi and surrounding areas. This does not exclude other areas, but the same access routes will be used. Product will be split between the WCM processing plant and customers. For the purpose of the report the specialist complied with the Manual for Traffic Impact Studies and work on the peak traffic hours on the adjacent road network. In this instance they fall at the same time as the admin office hours. The peak hour trips are as follows:

- Year 1: 28 morning and afternoon peak hour trips; and
- Year 6: 109 morning and afternoon peak hour trips

The transport used by workers will consist of buses and minibuses, and provision should be made to accommodate this on site. The specialist expected this service to be run by the mine. Taking the current developments in the area into consideration, it is expected

public transport operators to start operating on a much larger scale in the surrounding area in the near future. Provision should therefore be made to accommodate such operators on the site in future as well.

7. PROPOSED MINING DESIGN, METHODOLOGY AND INFRASTRUCTURE / PROJECT DESCRIPTION

Mining methods vary widely and depend on the location, type and size of mineral resources. Typical mine infrastructure includes haul roads; spoil dumps, surface and underground facilities (e.g. offices, workshops, parking, warehouses, etc.), tailings and waste rock disposal areas; transport and service corridors (e.g. roads, pipelines, conveyors, power and water corridors), product stockpiles, chemicals and fuel storage and housing facilities.

Unless otherwise stated, the information contained below regarding the mining design, methodology and infrastructure proposed for the proposed Elandsdrift Opencast Chrome Mine, has been extracted directly from the latest Mining Works Program (MWP) [Annexure 4].

As part of the proposed opencast operation ore will be loaded into trucks and transported via the haul roads from the open pit to the crushing and screening plant. The ore will be crushed and screened to achieve a desired material size before selling the ore. The opencast mining area will stretch over a strike length of some 3 624 meters. The opencast mining area has been sub-divided into four main pits based on geological disturbances or previously mined areas. Pit 1 is located to the far western boundary of Elandsdrift and the pits progress to the east where the final pit, Pit 4 is located on the far eastern boundary of the farm (McQuade, 2013).

7.1 Mining design and methodology

7.1.1 Mining method

The opencast mining area stretches over a strike length of some 3 624 meters. The opencast mining area has been sub-divided into four main pits based on geological disturbances or previously mined areas. Pit 1 is located to the far western boundary of Elandsdrift and the pits progress to the east where the final pit, Pit 4 is located on the far eastern boundary of the farm.
Key assumptions with respect to project timing used in constructing the financial model are illustrated in the four production profiles of the pits (McQuade, 2013).

7.1.2 Life of Mine and Production Schedule

Samancor has a long established reputation for product quality and supply continuity. This is maintained by sophisticated laboratory analysis, stringent controls and plant efficiencies, strictly complying with rules governing the determination of product and process characteristics. A fully-equipped central laboratory, ISO9002 and SANAS17025 accredited by SANAS exists where representative samples are routinely analysed. Independent laboratories regularly check control samples. WCM operations produce a range of products as presented in **Error! Reference source not found.** (McQuade, 2013).

Table 24: Products produced by Samancor Chrome Limited Western Chrome Mines (McQuade, 2013)

PRODUCT	TYPICAL SIZE(MM)	PRODUCTION PER MONTH(MT)
Lump	-100+25	569 856
Small Lump	-15+6	29 125
Chips	-6+2	115 730
Foundry sands	<1	203 875
Chemical concentrate	<1	52 813
Metallurgical concentrate	<1	706 474

A list of products to be produced from the proposed Elandsdrift opencast mine at a 60% mass yield and their proportionate quantities are presented in Table 25 (McQuade, 2013).

Table 25: Products produced by the Elandsdrift Opencast Mine (McQuade, 2013)

PRODUCT	TYPICAL SIZE(MM)	PRODUCTION PER MONTH(MT)
Lump	-100+25	9 575
Small Lump	+16-25	4 075
Chips	+6-16	1 600
Metallurgical Concentrate	<1	14 750
	Total	**30 000**

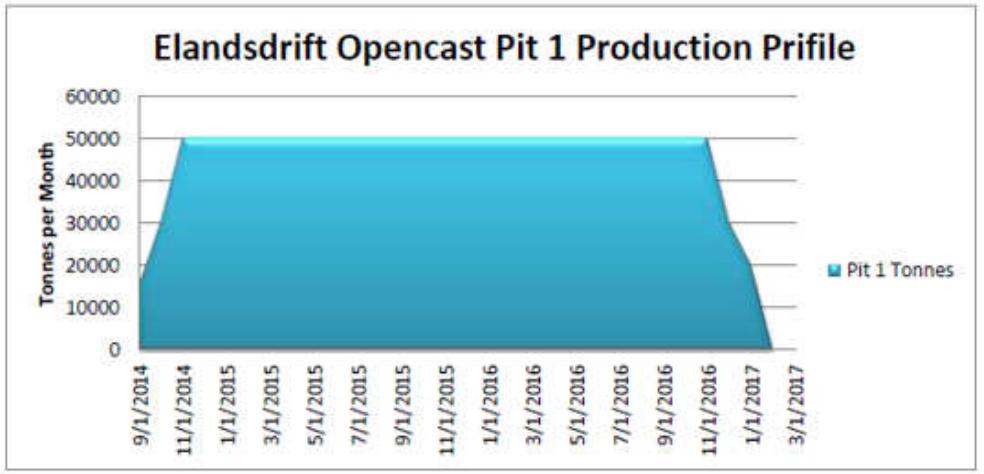
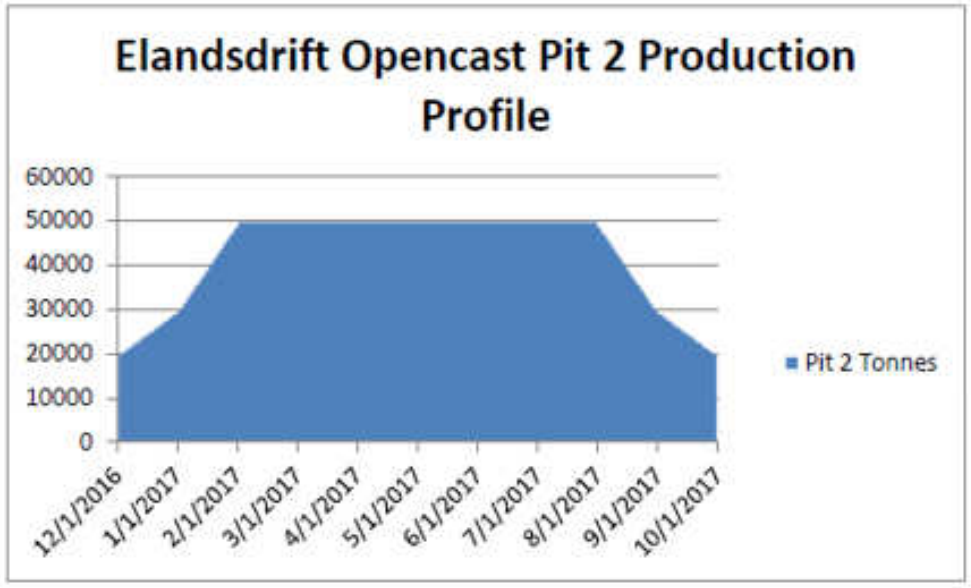
Based on a production rate of 50 000 tons of RoM ore per month, the life of mine for the opencast mine will vary between approximately 31 months (MG1 only) to almost 12 years (for the MG1-MG2-MG3-MG4 combination). Hence the maximum period of 30 years is requested for this application (McQuade, 2013).

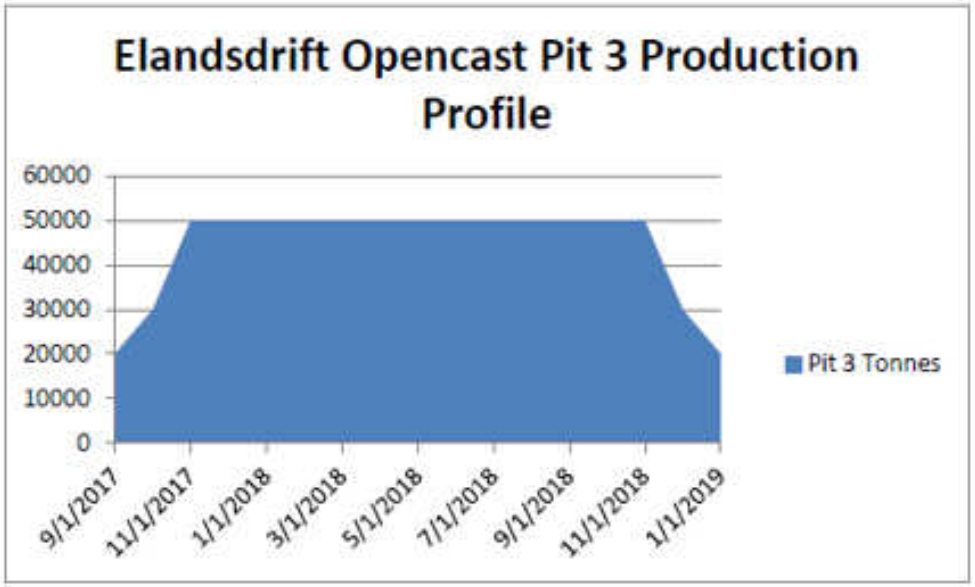
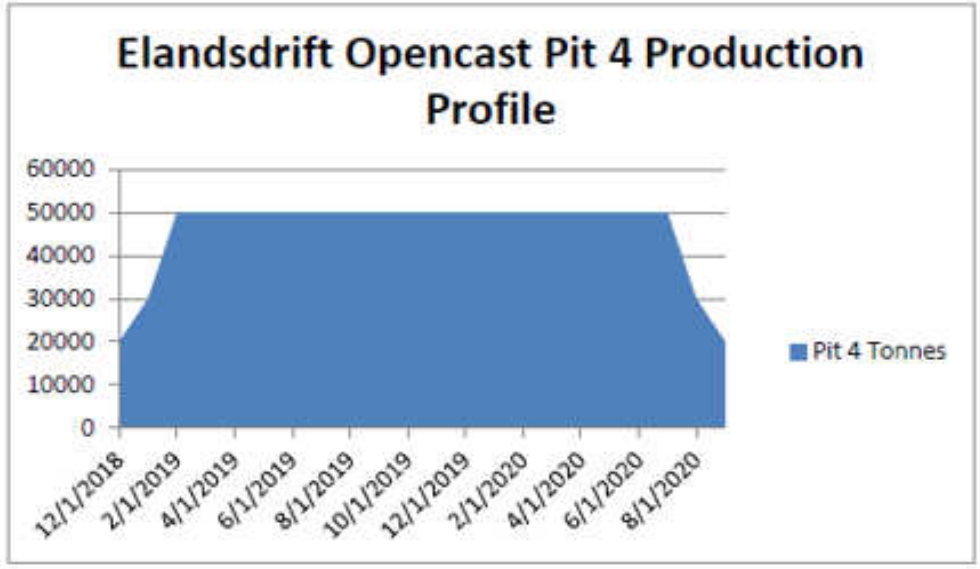
It is assumed that the construction of the engineering and surface infrastructure for the site would be spread over 2 to 3 months. This would include the provision of bulk services (water and permanent power). Open pit mining operations are planned to continue for 72 months and on the MG1 and MG2 seams. The open pit will however extract all chromitite layers present namely the MG0, MG1, MG2, MG3, MG4, although the MG3 and MG4 will be stockpiled. Three alternative mining configurations have been considered for the opencast operations, with each one having a different LOM:

- MG1 chromitite layer only ending June 2017 (34 months);
- MG0 +MG1 + MG2 chromitite layers ending January 2020 (6 years);
- MG0 + MG1 + MG2 + MG3 + MG4 chromitite layers ending November 2029 (McQuade, 2013).

Based on a production rate of 50 000 tons of ROM ore per month, the life of mine for the opencast will vary between approximately 31 months (MG1 only) to almost 12 years (for the MG1-MG2-MG3-MG4 combination). Hence the maximum period of 30 years is requested for this application. For purposes of this submission, all economically viable chromitite layers will be extracted from the open pit mining operations (McQuade, 2013).

Table 26: Life of Mine and Production Schedule as contained in the Mining Works Program (McQuade, 2013)

	ACTION	TIMEFRAME	ESTIMATED PRODUCTION
Pit 1	1. Project start, site establishment 2. Preparation of temporary offices / facilities 3. Construction of surface infrastructure, services and access roads 4. Commence with stripping of topsoil 5. First ore available from open pit 6. First ore to the processing plant 7. Steady state production from opencast	1. August 2014 2. August 2014 3. August 2014 4. August 2014 5. September 2014 6. November 2014 7. November 2014	
Pit 2	1. Pit 2 commences with overlap of Pit 1 closure 2. Commence stripping of topsoil 3. First ore available from open pit 4. First ore fed to the processing plant 5. Steady state production from opencast	1. October 2017 2. October 2017 3. November 2017 4. February 2018 5. February 2018	

Pit 3	1. Pit 3 commences with overlap of Pit 2 closure 2. Commence stripping of topsoil 3. First ore available from open pit 4. First ore fed to the processing plant 5. Steady state production from opencast	1. July 2018 2. July 2018 3. September 2018 4. November 2018 5. November 2018	
Pit 4	1. Pit 3 commences with overlap of Pit 2 closure 2. Commence stripping of topsoil 3. First ore available from open pit 4. First ore fed to the processing plant 5. Steady state production from opencast 6. Opencast closure	1. October 2018 2. October 2018 3. November 2018 4. December 2018 5. February 2019 6. August 2020	

7.2 Mining infrastructure

The proposed opencast at Elandsdrift is linked by gravel roads to the D314 provincial tar road. All gravel roads to and from the project area are existing roads used almost on a daily basis. Water to the proposed mining site is obtained as is currently the case for the underground mine of Elandsdrift from Rand Water Board (RWB) pipeline and piped for 3.1 km to the mine site. Eskom power is available on site. The entire mining area falls within the previous Elandsdrift Chrome Mining area, which has existing infrastructure in place to accommodate the planned opencast mining activities. The planned mining operation will be an opencast operation, which does not require electricity for ventilation, conveyors, chairlift, skips, winches etc. is required as is the case in underground mining. Lighting for the pit operations at night will be the main use of electricity (McQuade, 2013).

The infrastructure proposed for the Samancor mining operations on the afore-mentioned properties includes inter alia:

- Surface storage and reticulation of potable water;
- Dirty water pumping and settling infrastructure;
- Pollution control;
- Surface electrical reticulation;
- Stand-by generators;
- Paved access and internal roads and parking areas;
- Admin offices and workshops;
- Stores and bulk fuel supply; and
- Change house and laundry (McQuade, 2013).

There will be no beneficiation plant for this application. The process will consist of crushing and screening to produce the various saleable products. Waste product will be deposited on waste rock dumps and later backfilled into the opencast void. Shown below is a schematic flow sheet (Figure 26) and description of the major items in the proposed Elandsdrift plant (McQuade, 2013).

The major items of equipment that will be used in the mobile plant are the following:

- A mobile / moveable crushing unit will crush the oversized ROM ore that exceeds +100mm after it has passed over the screen;
- Front loaders and dump trucks will be used to transport the ROM ore and products in the following three main areas;
  - RoM ore from opencast pit to the ROM screening area,
  - Between the different sizing / screening steps, and
  - Final products to the various product stockpiles based on size and quality.
- Front loaders will be used to feed ROM material onto the screen.
- Screens will be used to separate the ROM material into different sizes as final product (McQuade, 2013).

Table 27: Efficiency of the process (McQuade, 2013)

PRODUCT	TYPICAL SIZE (mm)	PRODUCTION PER ANNUM (tons)
Lump	-100+25	114 900
Small lump	+25-6	48 900
Chips	+1-6	19 200
Chrome fines	-1	177 000

Due to the mining method being opencast mining the mining recovery is expected to be between 90 – 95 % with minimal dilution (McQuade, 2013).

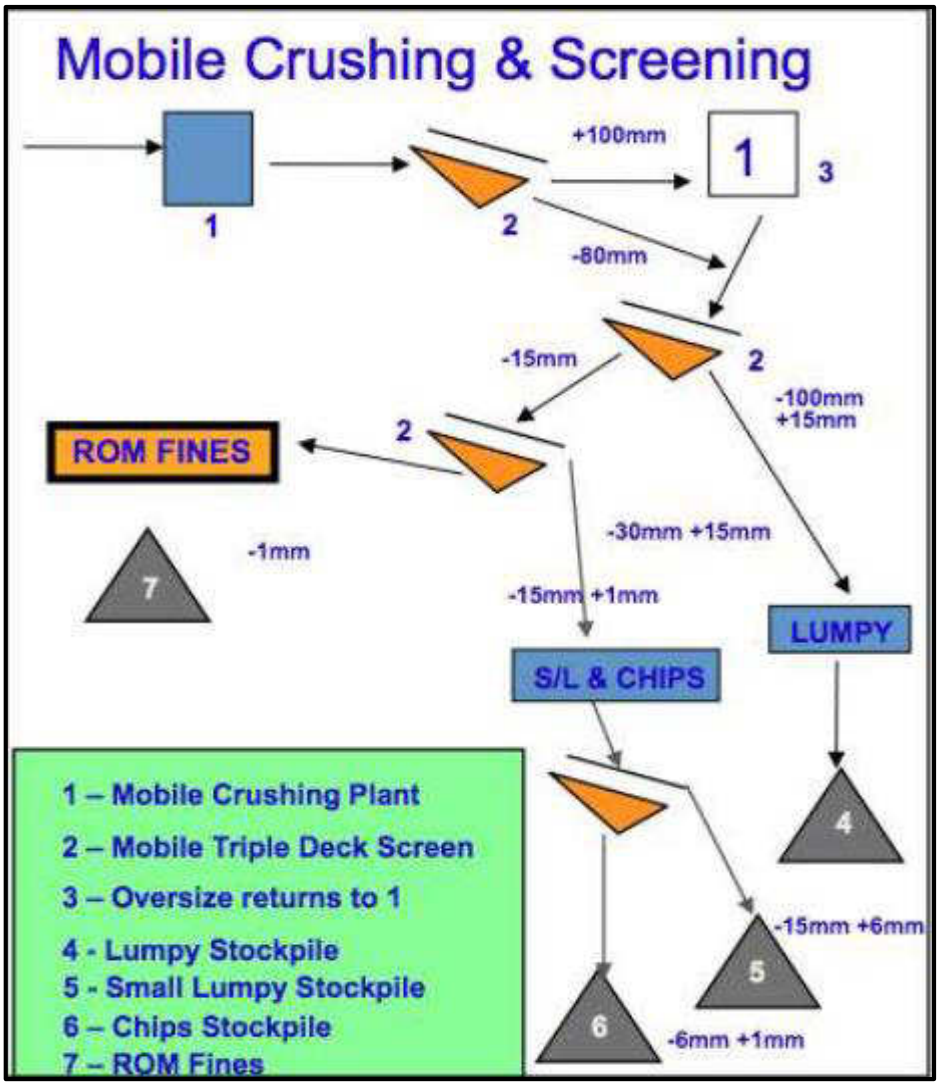


Figure 26: Components of the crushing and screeining plant (McQuade, 2013)

Wastewater Treatment

All sections' tailings dams are clay "turf" lined penstock dams with stormwater catchment paddocks from which effluent is transferred to the unlined return water dams. On all sites the return water dams are used as pollution control dams too, thus significantly reducing the capacities of the pollution control dams (McQuade, 2013).

Water Treatment Plant

Elandsdrift Mine operates a waste water treatment works and produces an effluent that falls within the ambit of the standards as contemplated in section 39 of the NWA which is considered as General Authorised. Low levels of chlorophyll-a concentrations were evident in the Elandsdriftspruit and indicates potential oligotrophic conditions with little risk of algal blooms. There was also a slight downstream increase in chlorophyll-a levels in this river, indicating some downstream nitrification (McQuade, 2013).

Process Water Supply system

Process water at all sites at Elandsdrift Mine is sourced predominately from de-watered groundwater from the shafts, with other contributors being captured rainwater and Rand Water Board. The process water at these sections is transferred on surface by pipelines and underground by canals and pipeline. The process water is constantly reused with minimal losses to evaporation, retention in product and seepage results in large amounts of excess water on all sections (McQuade, 2013).

Mineral Processing plant

Elandsdrift has an existing mineral processing plant that refine the chrome ore by means of crushing, screening, heavy medium separation and gravity separation methods. The capacity of the plant is to treat 56 700 tpm. The Run of Mine (ROM) ore is crushed to -120 mm before screening into different size fractions by a vibrating screen. At the HMS plant the +25 mm fraction is separated into product and waste by means of dense medium separation in a Wemco drum. At the chips plant the – 25 mm +2 mm size fraction is separated into waste and product by means of a dense medium cyclone. The -2 mm size fraction is stored in bins from where it is fed to the wash plant so as to be upgraded on spirals to produce high grade products and tailings waste. The product is pumped to stockpiles via dewatering cyclones. Water used in the plant is mainly water that is recycled from the return water dam, as well as small quantities from underground. Potable water from the Rand Water Board is also used in the plant if no other water is available. All the water in the plant is recycled and is therefore utilized in a closed water system. All products are stockpiled wet before dispatch by means of rail and road (McQuade, 2013).

Stormwater

Stormwater management infrastructure that serves to separate clean and dirty water had been designed to comply with Regulation 704 of the National Water Act of 1998. Clean and dirty water separation will be achieved through the construction of a series of canals designed to function up to the 1:50 year time of concentration storm runoff and to not suffer any significant damage up to the 1:10 year event. The clean diversion canals will not be lined and stormwater diversions will be discharged to surface water. Erosion protection and appropriate energy dissipation structures will be provided at each discharge point. Dirty areas will be reduced to a minimum to reduce the quantity of dirty water that has to be collected and treated. Stormwater management infrastructure will be established to prevent suspended solids and other pollutants from the construction sites from entering watercourses. Good housekeeping will be practised to reduce the pollution potential to a minimum (McQuade, 2013).

8. ALTERNATIVES [REGULATION 31 (2) (g)]

8.1 Identification of Alternatives

Feasible and reasonable alternatives have to be identified for a development as required by the NEMA EIA Regulations and applicable to BAs, SRs and EIARs. Each alternative is to be accompanied by a description and comparative assessment of the advantages and disadvantages that such development and activities will pose on the environment and socio-economy. When no feasible and/or reasonable alternatives could be identified and investigated in terms of a comparative assessment during the Scoping phase, no alternatives could be investigated during the EIA phase. Alternatives forms a vital part of the initial assessment process through the consideration of modifications in order to prevent and/or mitigate environmental impacts associated with a particular development. Alternatives are to be amended when the development's scope of work is amended. It is vital that original as well as amended alternative identification, investigation and assessment together with the generation and consideration of modifications and changes to the development and activities are documented (WC DEADP, 2011).

The EIA Regulations defines alternatives as the different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

a) The property on which or location where it is proposed to undertake the activity;
b) The type of activity to be undertaken
c) The design or layout of the activity;
d) The technology to be used in the activity
e) The operational aspects of the activity; and
f) The option of not implementing the activity.

Although an array of alternatives could be investigated for each project, such alternatives will not necessarily be applicable to each project and/or project phase. However there must always be strived to seek alternatives that maximises efficient and sustainable resource utilisation and minimise waste production.

8.2 Feasible Alternatives

Table 28: Feasible alternative analysis

TYPE OF ALTERNATIVE: **Location**	ALTERNATIVE EXPLANATION: • *Develop on an alternative property* • *Develop on alternative sites on the same property/properties*
No location alternatives are applicable to this project since the chrome is contained in an underlying belt in the development area. Locating the development in another area will resulting in the ore not being utilised and the economy and society will not be benefiting from the Elandsdrift Opencast Chrome Mine.	
TYPE OF ALTERNATIVE: **Activity**	ALTERNATIVE EXPLANATION: *Develop an alternative activity ex. Incineration of waste vs. landfill disposal, abstraction of water vs. re-use/recycling of water.*
Opencast mining is the only feasible and efficient alternative to extract and beneficiate the chromitite.	
TYPE OF ALTERNATIVE: **Design**	ALTERNATIVE EXPLANATION: *Adapt architectural and/or engineering designs.*
Due to the mining method being opencast mining the mining recovery is expected to be between 90 – 95 % with minimal dilution and with there being no gravity / spiral separation required, no waste will be generated from the ROM that is screened. This method has been tested and proven successful in a similar type of opencast design neighbouring the application area. Thus no tailings or waste is produced. All sections' tailings dams are clay "turf" lined penstock dams with stormwater catchment paddocks from which effluent is transferred to the unlined return water dams. On all sites the return water dams are used as pollution control dams too, thus significantly reducing the capacities of the pollution control dams. Elandsdrift Mine operates a waste water treatment works and produces an effluent that falls within the ambit of the standards as contemplated in section 39 of the NWA which is considered as General Authorised. Low levels of chlorophyll-a concentrations were evident in the Elandsdriftspruit and indicates potential oligotrophic conditions with little risk of algal blooms. There was also a slight downstream increase in chlorophyll-a levels in this river, indicating some downstream nitrification. Process water at all sites at Elandsdrift Mine is sourced predominately from de-watered groundwater from the shafts, with other contributors being captured rainwater and Rand Water Board. The process water at these sections is transferred on surface by pipelines and underground by canals and pipeline. The process water is constantly reused with minimal losses to evaporation, retention in product and seepage results in large amounts of excess water on all sections. Elandsdrift has an existing mineral processing plant that refine the chrome ore by means of crushing, screening, heavy medium separation and gravity separation methods. The capacity of the plant is to treat 56,700 tpm. The Run of Mine (ROM) ore is crushed to -120 mm before screening into different size fractions by a vibrating screen. At the HMS plant the +25 mm fraction is separated into product and waste by means of dense medium separation in a Wemco drum. At the chips plant the – 25 mm +2 mm size fraction is separated into waste and product by means of a dense medium cyclone. The -2 mm size fraction is stored in bins from where it is fed to the wash plant so as to be upgraded on spirals to produce high grade products and tailings waste. The product is pumped to stockpiles via dewatering cyclones. Water used in the plant is mainly water that is recycled from the return water dam, as well as small quantities from underground. Potable water from the Rand Water Board is also used in the plant if no other water is available. All the water in the plant is recycled and is therefore utilized in a closed water system. All products are stockpiled wet before dispatch by means of rail and road.	
TYPE OF ALTERNATIVE: **Layout**	ALTERNATIVE EXPLANATION: *Adapt spatial configurations of an activity on any particular site ex. Locate manure dams away from water resources.*
No alternatives in terms of layout have been investigated.	

TYPE OF ALTERNATIVE: **Technological**	ALTERNATIVE EXPLANATION: *Adapt methods or processes that can be implemented to achieve the same goal ex. Introduction of bacteria rather than chemicals to waste water.*
No alternatives in terms of technology have been investigated.	
TYPE OF ALTERNATIVE: **Demand**	ALTERNATIVE EXPLANATION: *The demand for products and/or services can be met by other means ex. The demand for paper can be met through deforestation or rather by efficient and viable recycling.*
Not applicable	
TYPE OF ALTERNATIVE: **Input**	ALTERNATIVE EXPLANATION: *Implement different input materials and/or sources ex. Utilisation of woodchips for fuelling boilers rather than electricity.*
No input alternatives in terms of input have been investigated.	
TYPE OF ALTERNATIVE: **Routing**	ALTERNATIVE EXPLANATION: *Implement alternative routes for linear developments such as power line servitudes, transportation and pipeline routes ex. Elongate and divert a railway line to exclude a sensitive environment.*
Not applicable.	
TYPE OF ALTERNATIVE: **Scheduling and Timing**	ALTERNATIVE EXPLANATION: *Adapt the order and/or scheduling of a number of measures which plays a part in a program as it will influence the overall effectiveness of the end result.*
Rehabilitation of the opencast mining area will be done concurrently with the opencast mining according to a stated mining sequence.	
TYPE OF ALTERNATIVE: **Scale**	ALTERNATIVE EXPLANATION: *Adapt the scale of an activity ex. 15 vs. 35 housing units, 12m^2 vs. 0.5km^2.* *P.S. Scale and magnitude is inter related.*
No alternatives in terms of scale have been investigated.	
TYPE OF ALTERNATIVE: **Magnitude**	ALTERNATIVE EXPLANATION: *Adapt the magnitude which is directly related to the extent of an activity.* *P.S. Scale and magnitude is inter related. An activity may be very small scale but can pose an extensive magnitude ex. Destroying an extremely sensitive wetland on a very small scale could result in a magnitude of such as destroying the whole wetland and/or ecological system.*
No alternatives in terms of magnitude have been investigated.	
TYPE OF ALTERNATIVE: **No-go**	ALTERNATIVE EXPLANATION: *The option of not undertaking and implementing the activity at all.*
The current land use is predominantly agriculture, where land is planted to crops or pastures for grazing. The no-mining option will result in the continuation of such land use. Although economically viable, the continuation of agriculture will not provide the level of short-term economic growth to the area that mining would offer. Economic growth benefits include: employment opportunities for residents in the area, greater economic input as a result of the mine's implementation of their approved social and labour plan, allowing better development of the municipal infrastructure and greater socio-economic stability in the area. After mine closure and rehabilitation of mined areas, the land capability may return to grazing or crop cultivation, allowing the continuance of certain agricultural practices. The mine will also promote sustainable local economic development, to give communities the skills required to remain economically viable and successful after mine closure. If the project were not to proceed, the additional economic activity and skills development would not be created. The chrome reserves would remain unutilised, the current land uses and economic activities would continue as at present, with little economic growth developing in the region. .	

9. PUBLIC PARTICIPATION PROCESS [REGULATION 31 (2) (e) (i-iv) AND REGULATION 54-57)]

9.1 Introduction to public participation

Guideline 7 on "Public Participation in the Environmental Impact Assessment Process", published by Department of Environmental Affairs (DEA) in October 2012, states that public participation is one of the most important aspects of the environmental authorisation process. This stems from the requirement that people have a right to be informed about potential decisions that may affect them and that they must be afforded an opportunity to influence those decisions. Effective public participation also facilitates informed decision-making by the CA and may result in better decisions as the views of all parties are considered.

The benefits of public participation include the following:

- Provides an opportunity for I&APs, EAPs and the CA to obtain clear, accurate and understandable information about the environmental impacts of the proposed activity or implications of a decision;
- Provides I&APs with an opportunity to voice their support, concerns and questions regarding the project, application or decision;
- Provides I&APs with the opportunity of suggesting ways of reducing or mitigating negative impacts of an activity and for enhancing positive impacts;
- Enables the Applicant to incorporate the needs, preferences and values of affected parties into the application;
- Provides opportunities for clearing up misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;
- It is an important aspect of securing transparency and accountability in decision-making; and
- Contributes toward maintaining a healthy, vibrant democracy.

All PPP undertaken is in accordance with the requirements of the EIA Regulations (2010) [Refer to the Public Participation Report as per Annexure 6.

9.2 Public participation activities taken to date [Regulation 31 (2) (e) (i)]

The following PPP tasks were conducted to date for the proposed Elandsdrift Opencast Chrome Mine:

- Identification of key Interested and Affected Parties (affected and adjacent landowners) and other stakeholders (organs of state and other parties);
- Formal notification of the application to key I&APs (all adjacent landowners) and other stakeholders;
- Consultation and correspondence with I&APs and Stakeholders and the addressing of their comments; and
- Release of the Draft Scoping Report, Final Scoping Report (FSR) and Draft Environmental Impact Assessment (EIA) report to I&APs and stakeholders for review and comment.

9.2.1 I&AP and stakeholder identification, registration

Public Participation is the involvement of all parties who are either potentially I&AP by the proposed development. The principle objective of public participation is to inform and enrich decision-making. This is also its key role in this EIA process.

Interested and Affected parties representing the following sectors of society have been identified:

- National, provincial and local government;
- Agriculture, including local landowners;
- Community Based Organisations;
- Non-Governmental Organisations;
- Water bodies;
- Industry and mining;

- Historically disadvantaged groups, including women, youth and the disabled;
- Research; and
- Other stakeholders.

Key stakeholders, who included the abovementioned sectors, were directly informed of the proposed development by mail, email and fax on 30 July 2013 (Refer to the Public Participation Report as per Annexure 6).

9.2.2 Formal notification of the application

The project was announced as follows:

Newspaper advertisement

Newspaper advertisements were published in:
- Rustenburg Herald: 19 October 2013;
- Rustenburg Herald: 22 November 2013;
- Platinum Weekly: 15 November 2013; and
- And re-advertised in the Rustenburg Herald informing stakeholders of the new reference number and the availability of the Scoping report on 7 March 2014.

Site notice placement

In order to inform surrounding communities and adjacent landowners of the proposed development, 6 site notices were erected on site and at visible and accessible locations close to the site (Refer to the Public Participation Report as per Annexure 6).

Written notification

I&AP's and other key stakeholders, who included the above-mentioned sectors, were directly informed of the proposed development by e-mail/ fax/ letter on 30 October 2013. The Background Information Document (BID) and Registration and Comment sheets were also supplied to all parties. I&APs were given 30 days to comment and / or raise issues of concern regarding the proposed development. The commenting period expired on 3 November 2012. (Refer to the Public Participation Report as per Annexure 6).

Public / open house meetings

A public / open house meeting was held on 27 November 2013 and on 8 April 2014 (16:00-18:00) at Elandskraal Primary. All Interested and Affected parties (I&APs) were invited and formally notified.

9.2.3 Consultation and correspondence with interested and affected parties [Regulation 31 (2) (e) (iii)]

Interested and Affected Parties had the opportunity to raise issues either in writing, by telephone, fax and/or email. In addition a public / open house meetings were held on 27 November 2013 (16:00-18:00) as well as on 08 and 17 April 2014 at Elandskraal Primary School.

All Interested and Affected parties (I&APs) were invited and formally notified. This included stakeholders from:
- National, provincial and local government;
- Agriculture, including local landowners (affected and adjacent);
- Community Based Organisations;
- Water bodies;
- Industry and mining;
- Commerce; and
- Other stakeholders.

Interested and Affected Parties had the opportunity to raise issues either in writing, by telephone, fax and/or email. Refer to Annexure 6 for the Public Participation Report.

Table 22 contains a list of the issues raised by interested and affected parties and a summary of the comments and responses. Comments and responses will be added as the process proceeds and as comments are received. Copies of all correspondence between the Environmental Assessment Practitioner (EAP) and interested and affected parties and stakeholders and the comments and responses report recording comments and responses in detail are included in Public Participation Report [Regulation 31 (2) (e) iv)] in Annexure 6.

Table 29: List of issues raised and summary of comments and responses

ISSUE RAISED	COMMENTS	RESPONSE
Servitudes	• Transnet is not affected by this development, they will raise no objection against the project. • Sasol Gas Limited has no objection against the development. The way leave granted is valid for 12 months. • SANRAL acknowledged receipt of correspondence pertaining to the proposed Samancor Elandsdrift project, and requested additional maps showing how far the proposed activity is from any National Road.	The separate parties will be informed should any changes take place and possible impacts occur on the servitudes and the necessary maps were furnished to SANRAL.
EIA process	The Madibeng Local Municipality has evaluated the scoping report in line with the EIA Regulations and other legislation pertaining to Environmental Impact Assessments and has no objection as long an an Environmental Management Programme is implemented and followed.	The EMPr will be prepared in accordance with the EIA as well as all impacts and mitigation measures identified.
Water	Deterioration of water (water quality) and decrease in borehole water yield (water quantity). Boreholes are used for drinking (domestic) and farming.	The concerns have been noted. The necessary specialist studies (including ground- and surface water) were undertaken and included in Annexure 8.2 and 8.3.
Roads and infrastructure	• Safety and nuisance due to heavy vehicle movement. • Underground water pipelines may be damaged.	Assessments of alternatives is one of the requirements in the EIA process, various alternatives for access routes have been investigated and will be presented in the EIA phase of the project. Samancor is a safety conscious mining enterprise and as such takes safety issues seriously and will ensure movement of trucks is undertaken in a safe and responsible manner
Health, Safety and Security	• Security & Safety of people including increased crime rates due to the development. • Privacy of Land owner and Tenants • Health of people, animals and plants • Crime escalation • Informal settlements and businesses	• It is proposed that a security boundary will be implemented at the mine so as to restrict access to and from the mine. • A visual impact assessment was undertaken so as to investigate further the visual intrusion emanating from establishment of the mine. Refer to Annexure 3.8. • Issues relating to animals and plants was

		investigated in various flora and faunal assessments during the EIA phase. Refer to Annexure 8.4. • Samancor will use contractors to mine and they won't be staying on site. Approximately 70 contractors will be used for the opencast. • The Local municipality is also planning township developments which will alleviate the problem of housing in the area.
Noise and air quality	• Noise and Safety of Machinery the Mines going to use • Air Pollution and Dust of Mining • Blasting and shaking of ground (cracks on buildings) – Tharisa and Lonmin Mines are already a problem. • Noise from blasting and trucks (reverse hooters and loading of ore • Excessive amounts of dust are generated by mining activities.	• Samancor undertakes to do vibration monitoring at the particular houses experiencing vibrations during the mining operational phase. • It is the intention of Samancor to make use of single blasting and avoid multiple blasting. Furthermore loading times by tracks are to be considered so as to create a scenario where there is limited noise pollution. • Dust mitigation measures are included in the EMPr (Refer to Annexure 8).
Environmental monitoring	Mr Bennett indicated that when mines get what they want they don't care anymore and do not respond to any issues raised during operation. 'Accumulative impacts' and wanted to know how are anticipated issues to be resolved?	Samancor Chrome indicated that all issues raised during operations are taken very seriously by the mine. Furthermore a system exists whereby all complaints are recorded, investigated and complainants are given feedback. Top management have access to the system. Samancor Chrome is well aware that by not addressing issues/concerns raised during operation they will be risking their mining licence, therefore they have a vested interest in ensuring that all issues are addressed.

9.2.4 Release of the draft and final scoping reports and the draft EIA report

The Draft Scoping Report (DSR) and Plan of Study (PoS) were released for public review and comment for 40 calendar days (17 March 2014 to 18 May 2014.). Additional days were added to the commenting period in order to compensate for the March and April public holidays. Hardcopies of the DSR were submitted to all Organs of State and relevant authorities. In addition hard copies were placed at the Marikana Public library (Tel: 014 572 3611) and on the ENVASS website (www.envass.co.za).

The Final Scoping Report (FSR) and PoS were released for public review for 21 days as from 10 June 2014 to 30 June 2014 and in the same manner as the DSR was made available.

The Draft EIA and EMP were released for public review and comment for 40 calendar days (11 November 2014 - 9 January 2015). Additional days were added to the commenting period in order to compensate for public holidays. Hardcopies of the document were submitted to all Organs of State and relevant authorities. In addition a hard copy was placed at the Samancor Western Chrome Mine's Security Office and the report was also available on the ENVASS website (www.envass.co.za).

9.2.5 Next phases of the public participation process

The Final EIA and EMP are herewith released for public review and comment for 21 calendar days ***(13 March 2015 – 2 April 2015)***. Hardcopies of the document are submitted to all Organs of State and relevant authorities. In addition a hard copy is available at the Samancor Western Chrome Mine's Security Office and the report is also available for download on the ENVASS website (www.envass.co.za).

10. ENVIRONMENTAL IMPACT ASSESSMENT PROCESS [REGULATION 31 (2) (h, k, and l)]

10.1 Impact assessment methodology [Regulation 31 (2) (h)]

A "significant impact" is defined as it is defined in the EIA Regulations (2010): "an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect of one or more aspects of the environment". The objective of this EIA methodology is to serve as framework for accurately evaluating impacts associated with current or proposed activities in the biophysical, social and socio-economical spheres. It aims to ensure that all legal requirements and environmental considerations are met in order to have a complete and integrated environmental framework for impact evaluations. The process of determining impacts to be assessed is one of the most important parts of the environmental impact assessment process. It is of such high importance because the environmental impacts identified can and are often linked to the same impact stream.

In this method all impacts on the biophysical environment are assessed in terms of the overall integrity of ecosystems, habitats, populations and individuals affected. For example the removal of groundcover for the sloping or scraping of an embankment, can lead to higher amounts of water runoff which increases the rate of erosion. Further down in the river the amount of sediment increases because of the increased erosion. A number of fish species cannot endure the high amount of sediment and moves off. The habitat is thus changed or in the process of changing. Thus one needs to understand that the root of the problem (removal of groundcover) is assessed in terms of the degree of change in the health of the environment and/or components in relation to their conservation value. Thus if the impact of removal of groundcover of a definable system is high and the conservation value is also high then the impact of removal of groundcover is highly significant.

10.2 Environmental impact assessment (EIA) 2010 requirements

The Environmental Impact Assessment (EIA) 2010 Regulations promulgated in terms of Sections 24 (5), 24M and 44 of the National Environmental Management Act (NEMA) (Act 107 of 1998) requires that all identified potential impacts associated with the proposed project be assessed in terms of their overall potential significance on the natural, social and economic environments.

The criteria identified in the EIA Regulations (2010) include the following:

- Nature of the impact;
- Extent of the impact;
- Duration of the impact;
- Probability of the impact occurring;
- Degree to which impact can be reversed;
- Degree to which impact may cause irreplaceable loss of resources;
- Degree to which the impact can be mitigated; and
- Cumulative impacts.

ENVASS has developed an impact assessment methodology (as defined in point 10.3 below) whereby the Significance of a potential impact is determined through the assessment of the relevant temporal and spatial scales determined of the Extent, Magnitude and ***Duration*** criteria associated with a particular impact. This method does not explicitly define each of the criteria but rather combines them and results in an indication of the overall significance.

10.3 ENVASS impact assessment methodology

10.3.1 Nature of the impact

The nature of an impact can be defined as "a brief description of the impact being assessed, in terms of the proposed activity or project, including the socio-economic or environmental aspect affected by this impact".

10.3.2 Extent of the impact

The extent of an impact can be defined as "a brief description of the spatial influence of the impact or the area that will be affected by the impact".

Table 30: Determining the extent of an impact

EXTENT Extent or spatial influence of impact	**Footprint**	Only as far as the activity, such as footprint occurring within the total site area
	Site	Only the site and/or 500m radius from the site will be affected
	Local	Local area / district (neighbouring properties, transport routes and adjacent towns) is affected
	Region	Entire region / province is affected
	National	Country is affected

10.3.3 Magnitude of the impact

The magnitude of an impact can be defined as: "a brief description of the intensity or amplitude of the impact on socio-economic or environmental aspects".

Table 31: Determining the magnitude of an impact

MAGNITUDE Magnitude / intensity of impact (at the specified scale)	**Zero**	Natural and/or social functions and/or processes remain *unaltered*
	Very low	Natural and/or social functions and/or processes are *negligibly* altered
	Low	Natural and/or social functions and/or processes are *slightly* altered
	Medium	Natural and/or social functions and/or processes are *notably* altered
	High	Natural and/or social functions and/or processes *severely* altered

10.3.4 Duration of the impact

The duration of an impact can be defined as "a short description of the period of time the impact will have an effect on aspects".

Table 32: Determining the duration of an impact

DURATION Duration of the impact	**Short term**	Construction phase
	Medium term	Operational phase and/or up to 3 years after construction
	Long term	Up to or more than 6 years after construction

10.3.5 Probability of the impact occurring

The probability of an impact can be defined as "the estimated chance of the impact happening".

Table 33: Determining the probability of an impact

PROBABILITY	**Unlikely**	*Unlikely* to occur (0 – 25% probability of occurring)
	Possible	*May* occur (26 – 50% chance of occurring)
	Probable	*Likely* to occur (51 – 75% chance of occurring)
	Definite	Will *certainly* occur (76-100% chance of occurring)

10.3.6 Degree to which impact can be reversed

The reversibility of an impact can be defined as "the ability of an impact to be changed from a state of affecting aspects to a state of not affecting aspects".

Table 34: Determining the reversibility of an impact

REVERSIBILITY	**Reversible**	Impacts can be reversed through the implementation of mitigation measures
	Irreversible	Impacts are permanent and can't be reversed by the implementation of mitigation measures

10.3.7 Degree to which impact may cause irreplaceable loss of resources

The irreplaceability of an impact can be defined as "the amount of resources that can/can't be replaced".

Table 35: Determining the irreplaceability of an impact

IRREPLACEABILITY Irreplaceable loss of resources	**No loss**	*No* loss of any resources
	Low	*Marginal* loss or resources
	Medium	*Significant* loss of resources
	High	*Complete* loss of resources

10.3.8 Degree to which the impact can be mitigated

The degree to which an impact can be mitigated can be defined as "the effect of mitigation measures on the impact and its degree of effectiveness".

Table 36: Determining the mitigation rating of an impact

MITIGATION RATING	**MITIGATED** **Degree impact can be mitigated**	High	*Impact 100% mitigated*
		Medium	*Impact >50% mitigated*
		Low	*Impact <50% mitigated*

10.3.9 Confidence Rating

Confidence in the assessment of an impact can be defined as the "level of certainty of the impact occurring".

Table 37: Determining the confidence rating of an impact

CONFIDENCE RATING	**CONFIDENCE**	Certain	Amount of information on and/or understanding of the environmental factors that potentially influence the impact is *unlimited and sound*
		Sure	Amount of information on and/or understanding of the environmental factors that potentially influence the impact is *reasonable and relatively sound*
		Unsure	Amount of information on and/or understanding of the environmental factors that potentially influence the impact is *limited*

10.3.10 Cumulative Impacts

The effect of cumulative impacts can be described as "the effect the combination of past, present and "reasonably foreseeable" future actions have on aspects".

Table 38: Determining the confidence rating of an impact

CUMULATIVE RATING	**CUMULATIVE EFFECTS**	Low	*Minor* cumulative effects
		Medium	*Moderate* cumulative effects
		High	*Significant* cumulative effects

10.3.11 Significance of impacts

Table 39: Significance determination

SIGNIFICANCE RATING	**SIGNIFICANCE**	**Neutral**	• Zero magnitude with any combination of extent and duration.
		Very low	• Low magnitude with a site specific extent and short term duration; OR • Very low magnitude with any combination of extent and duration except regional and long term duration.
		Low	• High magnitude with a site specific extent and short term duration; OR • Low magnitude with any combination of extent and duration except site specific and short term duration or regional and long term duration; OR • Medium magnitude with a site specific extent and short term duration; OR • Very low magnitude with a site specific extent and long term duration.
		Medium	• High magnitude with a local extent and medium term duration; OR • High magnitude with a regional extent and short term duration / a site specific extent and long term duration; OR • High magnitude with a regional extent and short term duration / a site specific extent and long term duration; OR • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration; OR • Low magnitude with a regional extent and long term duration; OR • Medium magnitude with any combination of extent and duration extent site specific and construction period or regional and long term.

		High	• High magnitude with a regional extent and long term duration; OR • High magnitude with either a regional extent and medium term duration / a local extent and long term duration; OR • Medium magnitude with a regional extent and long term duration.
		Very high	• High magnitude with a regional extent and long term duration; OR • High magnitude with either a regional extent / long term duration.

10.4 Environmental impact assessment and mitigation measures [Regulation 31 (2)]

Please refer to Annexures 7 and 8 for the full impact and significance assessment as well as their associated mitigation measures.

10.5 Findings and recommendations of any specialist report or report on a specialised process [Regulation 31 (2) (j)]

10.5.1 Soil and Land Capability Assessment

Reference is made to the Soil and Land Capability Assessment attached as Annexure 3.1.

- Only a small portion of area has soils with a class 4 land capability;
- The majority of area has very shallow rocky soils with rocky outcrops and has a class 8 land capability, and is therefore an area with little agricultural potential;
- The chemical analysis reflects soils with high pH, low Phosphate (P) and Potassium (K) values
- Mining activities will irreversibly impact the land capability of the soil;
- Proper management measures need to be implemented during construction, operations and decommissioning to prevent soil loss due to contamination; and
- Soils need to be stockpiled so that they can be used for rehabilitation.

10.5.2 Traffic Impact Assessment

Reference is made to the Traffic Impact Assessment attached as Annexure 3.9.

The proposed opencast mine is located on Portions 6, 64, 65, 69, 111 and 140 of the Farm Elandsdrift 467 JQ north of Mooinooi in North West Province. The mine is located north of the N4 between the N4 and Road D2170. Access can be obtained via an access interchange on the N4 via Road D314, then northwards to Road D2179 and then via Road D2170 to the mine. Access to the mine will be located on a Provincial road and the access point needs to be approved by the North West Province's Department of Public Works, Roads and Transport. The mine is not a land use for which trip generation figures are available in the "SA Trip Data Manual". The mine's trip generation is normally not associated with the peak traffic hour on the adjacent road network due to the fact that the mine operates in shifts. Its admin component however works during normal weekday hours. From a trip generation point of view, the mine's peak trip generation occurs around shift change times and before and after the admin office hours. The trip generation will therefore be based on employment figures and operational information provided to us for this project. The mine will commence with 248 staff members in Year 1, and this will increase to 1289 in Year 6. For the purposes of this report we will comply with the Manual for Traffic Impact Studies and work on the peak traffic hours on the adjacent road network. In this instance they fall at the same time as the admin office hours. The peak hour trips are as follows:

- Year 1: 28 morning and afternoon peak hour trips
- Year 6: 109 morning and afternoon peak hour trips

In terms of potential trip generation, this mine is a significant trip generator. If we summarize the peak hour trip generation at the various times during a normal weekday, the mine can generate the number of trips as presented in Table 40.

Table 40: Traffic schedule

Time of day	Trips in	Trips out
Shift change at 06:00	64	64
Admin at 07:00	88	21
Shift change at 14:00	79	79
Admin at 16:00	21	88
Shift change at 22:00	64	64
General	60	60
Trucks (Product)	76	76
Trucks (general)	20	20
Total trips (24 hour)	**472**	**472**

Three major intersections were analysed and the results of the capacity analyses indicated the following:

Intersection Road D314 and Road D2170

The intersection is upgraded with the following:

- 60m right-turn lanes on both approaches of Road D314
- 60m left slip lane on Road D314, southern approach

With this upgrade, all the approaches operate at acceptable levels of service during both peak traffic hours.

Intersection: Road D314 and northern terminal on the N4 interchange

The capacity analyses indicated that no upgrades are required at this intersection. If it is looked at the queue lengths, certain upgrades can be implemented to significantly reduce the queue lengths. This upgrade should therefore be monitored and mitigation measures implemented as and when it is warranted.

Intersection: Road D314 and northern terminal on the N4 interchange

The capacity analyses indicated that the upgrading required at this intersection will be required even without the expected traffic demand from the mine. As a result of the additional traffic from the mine, the upgrades are however required earlier. A traffic signal needs to be warranted; this signal is required only during the morning peak traffic hour between 06:00 and 07:30. The need for this upgrade should therefore be monitored and mitigation measures implemented as and when it is warranted.

The proposed mine development can be supported from a traffic flow point of view. In order to support the expected traffic demand from the mine, it is further recommended that:

- The mine obtains access off Road D314 approximately 1,3km from the intersection with Road D314;
- The following road and intersection upgrades are implemented:
    - Intersection: Road D314 and Road D2170:
        - 60m right-turn lanes on both approaches of Road D314;
        - 60m left slip lane on Road D314, southern approach;
    - Road D2170:
        - The section of the road between Road D314 and the access to the mine upgraded to a surfaced road. This section of road is approximately 1,3km long;
    - Access to the mine:
        - The following additional lane is proposed at the access to the mine on Road D2170:
        - 60m left-turn lane;

- All the road upgrades on the Provincial roads and the access road to be designed and approved by the relevant provincial road department and local authorities; and
- Provision to be made at the mine to accommodate public transport operators so that employees using these services can be dropped off and picked up safely on-site.

10.5.3 Ecological Impact Assessment

Reference is made to the Flora Assessment attached to the Biodiversity Assessment (Annexure 3.4).

The soil on the western half of the study site was deep turf with natural thornveld vegetation on the north-western quadrant of the site. The habitat on this part of the site was suitable for *Stenostelma umbelluliferum,* a very small milkweed species that is not threatened, but is of conservation concern. The Marula trees on the north-western quadrant of the site should be preserved *in situ*. A suitably qualified person should identify and mark the trees to facilitate preservation. A suitable buffer that will ensure persistence of the tree should be allowed around each Marula tree. Mamba Kop, an outcrop of rocks just to the north of the study site was deemed sensitive and care must be taken that mining activities do not impact on this sensitive area.

Reference is made to the Mammal Habitat Assessment attached to the Biodiversity Assessment (Annexure 3.4).

Ecologically, in terms of mammalian fauna, the site is generally disturbed or modified with moderate micro-habitat diversity, apart from the rocky hill where micro-habitat diversity is higher. This rocky hill is low and rather isolated, but may still accommodate moderate mammal diversity, compared to the rest of the site where the mammal diversity is not suspected to be high. Soils with conspicuously high clay content at the site may be a limitation to a number of small mammal species which prefer sandy soils. In terms of mammal diversity most of the site is of low sensitivity whereas the rocky hill, Mamba Kop that partially enters the site, is considered to be of medium sensitivity. Overall no loss of particular habitat or connectivity is foreseen should the proposed development be approved. It is unlikely that there are any mammal species which are threatened or of particular conservation concern at the site.

Reference is made to the Avifaunal Habitat Assessment attached to the Biodiversity Assessment (Annexure 3.4).

The proposed opencast mine will not have a negative effect on Red Data avifaunal species recorded for the 2527DA q.d.g.c. due to a lack of suitable breeding, foraging and/or roosting habitat. In general the entire area has been disturbed by past and present mining and agricultural activities. However the natural woodland habitat, especially the mixed *Acacia* and broadleaf woodland on and surrounding Mamba Kop offers suitable habitat for a variety of woodland avifaunal species. In order to ensure future avifaunal diversity on and surrounding the study site it is important that this habitat remain undisturbed and kept in a natural state and free from any form of disturbance. Most areas to the north, west and east of the study site are severely disturbed by mining activities. Although the recommended protected area will become isolated and fragmented from similar suitable natural habitat, avifaunal species can move to and from other suitable habitat to the south of the study site such as the Magaliesberg Protected Natural Environment (MPNE) and surroundings.

Reference is made to the Herpetofauna Habitat Assessment attached to the Biodiversity Assessment (Annexure 3.4).

The proposed development of opencast mining will inevitably transform large areas of natural habitat. Keeping the footprint of all activities as small as possible will be the initial focus of conservation and mitigation action, followed by the best possible practices for rehabilitation of the disturbed areas once mining has been completed. Considering the scale of the proposed mining activities, the loss of habitat and displacement of some herpetofauna is a foregone conclusion, particularly that of terrestrial species, but in the overall picture of the affected species, it will be minimal due to the distribution map of the effected species. However, maintaining (and even improving) the conservation integrity of the Elandsdriftspruit is imperative and non-negotiable. This water source should be regarded as sensitive, as such providing indispensable habitat for Red Listed and sensitive species as well as serving in places as a dispersal corridor. This implies that a buffer zone of 100 metres from the edge of the riparian zone must be included as

sensitive area. This will create many suitable habitats for water–dependent herpetofauna within the proposed study site and this may even improve the quality of the protected habitats. From a herpetological viewpoint it should benefit mainly the wetland-associated amphibians and reptiles. Should the proposed mining get authorised, an important indirect effect (siltation and pollution of the water) would be the likely impact the activities might have on the surface water runoff and water quality of the catchment area of the Elandsdriftspruit. This could have a negative impact on the herpetofauna. The effects could be ameliorated by the construction of retention ponds, which would retard discharge into the catchment area and improve the discharge water quality. The TOPS listed Southern African Python definitely occurs on the study site and there is a marginal possibility that the contentious Red Data Giant Bullfrog may occur on the study site. A permit must be obtained from the Department of Environmental Affairs before TOPS listed species may be disturbed, trapped, moved or killed as a result of the mining activities.

10.5.4 Surface Water Assessment

Reference is made to the Surface Water Assessment attached as Annexure 3.3.

The primary surface water impacts associated with the Elandsdrift Mine are the potential impacts on the regional water balance, water quality degradation due to incidental waste water discharges, stormwater management at the mine, and possible impacts on the Elandsdriftspruit within the Sterkstroom sub-catchment stemming from diffuse sources of pollution. The mining activities will probably have moderate significant accumulative impacts on surface water streams in the area and requires further consideration. Good opencast mining practice should be applied as part of integrated water resource management and to contain any water that may accumulate in the pits.

A stormwater management system should be designed for the mining site to ensure that sufficient storage capacity is created on site to accommodate storms with a 1:50 year return period (GN 704 Regulations), spillage frequencies should be less than 1 percent, taking into account the long-term rainfall record applicable to the project site and any abstraction for reuse from the stormwater dams, and to ensure that there is efficient separation of clean water and dirty water. Only clean water should be discharged to the stormwater system. Contaminated water should be contained and treated on site. The stormwater management system should comply with the Department of Water Affairs' Best Practise Guidelines (DWAF, 2006). The EMP and SWMP for the mine should also address measures to contain oil spills, good waste management practices, guidelines for the storage, handling, use and disposal of chemicals, etc. The disposal of effluent from the waste water treatment works needs to adhere to the Resource Quality Objectives set for the Sterkstroom sub-catchment to prevent degradation of water quality and the River Health Class. Transportation corridor – Good dust suppression practices should be applied to prevent spillage of material along the haul road or conveyor.

10.5.5 Bio monitoring (River Health) Assessment

Reference is made to the Elandsdrift River Health Assessment attached as Annexure 3.5.

The sampled sites presented slightly notable limitation with regards to the biotope availability, largely as a result of low flow and environmental effects currently taking place (i.e. current mining activities and road developments) around and within the catchment. The present low river flow conditions notably influenced the invertebrate movement as distribution patterns proved to be low. In conclusion, the final river health indicates that the sampled river sites are seriously modified. The South African Scoring System (SASS) score of these water channels ranges from 75 to 64 whilst the ASPT ranged from 4.69 to 5.33. The present ecological state value for both sites was Poor meaning that the state of the catchment was seriously altered and can have an effect on riverine ecosystem functioning. It is envisioned that since the systems shows water flow impairment, its state might change due to the accumulated human induced impacts happening around the catchment areas that would affect the riverine system in the long run. It is recommended that a bi-annual river health bio monitoring for the wet and dry season be conducted should the proposed activity be authorised to determine the effects of the opencast on the stream.

10.5.6 Geohydrological Assessment

Reference is made to the Geohydrological Report attached as Annexure 3.2.

The area is characterised by a generally flat topography in the area of the proposed opencast. The current status of the site cannot be declared as pristine as already there are mining activities in the surrounding area. A hydro census was conducted in and around the proposed opencast during November 2012. A total of 14 boreholes and 4 surface water bodies were identified during this hydro census. Groundwater levels varied between 7.4 6m and 18.40 m below ground level. The boreholes encountered during the hydro census within the mining area were drilled during the initial EMPr application for this same mine. These boreholes are BH65, 66, 68 that were known to exist within the mining boundary. Only BH68 was found during the hydro census. Groundwater usage in the area is limited to livestock watering, irrigation and domestic use. Groundwater samples were collected from 12 boreholes. The groundwater quality of the area can generally be classified as variable as some boreholes were found to exceed the allowable limit or were within Class II which can only be tolerated for a limited time.

Through numerical modelling the potential impact from the opencast were determined. The three (3) phases that were considered are the following:

- **Pre-mining Phase**: Start-up of mining operations at the specific site before actual mining operations commences.
- **Operational Phase:** The conditions expected to prevail during the mining of the new opencast.
- **Post-mining Phase:** This relates to the steady-state conditions following closure of the opencast mines. A period will be considered after which it is assumed that impacts will steadily decrease and start returning to normal.

A monitoring network (where applicable) as will be described should be put in place for all below described phases. The construction phase is not expected to influence the groundwater levels. With the exception of lesser oil and diesel spills, there are also no activities expected that could impact on regional groundwater quality. This phase should thus cause very little additional impacts in the groundwater quality. It is expected that the current status quo will be maintained. The operational phase is interpreted as the active mining of the proposed opencast. It is inevitable that these effects will impact on the groundwater regime. The potential impacts that will be considered are the groundwater quantity and quality. During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. Water entering the mining areas will have to be pumped out to enable mining activities. This will cause a lowering in the groundwater table in and adjacent to the mine.

The dewatering of the aquifer has been calculated for the opencast using the calibrated numerical model. The mining sequence was also taken in consideration when calculating the drawdown. A worst-case scenario has been modelled, assuming that all mining areas would be dewatered. This will obviously not be the case, and the actual drawdown could thus be less. Thus, the worst case scenario could also be close to the actual scenario. It can be concluded that

- Drawdown is not expected to influence any perennial streams in the area.
- There are privately owned boreholes in the potential affected area that might experience a decline in water levels of approximately 5 meters.
- Due to relative shallow depth of mining (40m). The extent of the cone of depression is expected to be less than 2km radius from the opencast.

During the post-mining phase of mining it is assumed that dewatering of the opencast will be ceased, and the surface of the opencast will be rehabilitated. The groundwater regime will return to a state of equilibrium once mining has stopped and the removal of water from the mining void has been discontinued. The rise in groundwater level is predicted to be relatively slow and the water levels are expected to recover only in about 10 - 20 years. The slow recovery is ascribed to the low hydraulic conductivity of the surrounding bedrock.

This phase of the mining process is the period following the completion of mining and rehabilitation of the proposed opencast. The following possible impacts were identified at this stage:

- Following closure of the opencast, the groundwater level will rise to an equilibrium that will differ from the pre-mining level due to the disturbance of the bedrock and increase in recharge from rainfall.
- Groundwater within the mined areas is expected to deteriorate due to chemical interactions between the geological and the groundwater. The resulting groundwater pollution plume will commence with downstream movement.

After closure, the water table will rise in the rehabilitated opencast to reinstate equilibrium with the surrounding groundwater systems. However, the mined areas will have a large hydraulic conductive compared to the pre-mining situation. This will result in a relative flattening of the groundwater table over the extent of the opencast mining area, in contrast to the gradient that existed previously. The end result of this will be a permanent lowering of the groundwater level in the higher topographical area and a rise in lower lying areas. Intuitively, it would be expected that this raise in groundwater could result in decanting of the opencast. The predicted groundwater levels indicate that decanting will most probably not occur. Once the normal groundwater flow conditions have been re-instated, polluted water can migrate away from the rehabilitated areas. As some discards will remain in the mine, this outflow will be contaminated as a result of acid or neutral mine drainage. The migration of contaminated water from the mining area has been modelled as described. As stated previously, the results must be viewed with caution as a homogeneous aquifer has been assumed. Heterogeneities in the aquifer are unknown and the effect of this cannot be predicted. Furthermore, no chemical interaction of the sulphate with the minerals in the surrounding bedrock has been assumed. As there must be some interaction and retardation of the plume, it is hoped that this prediction will represent a worst-case scenario.

Within the limitations of the abovementioned assumptions, it can be estimated that:
- Two privately owned boreholes (Bh9 and 10) are likely to be affected by sulphate pollution plume.
- Non-perennial stream monitoring should be done to establish whether any contamination from the opencast will be of significance, as the status of these streams were unknown during the modelling exercise.

10.5.7 Social Impact Assessment

Reference is made to the Social Impact Assessment attached as Annexure 3.6.

The significance and probability of *population related impacts* is high. Mitigation is expected to attenuate impacts relating to the inflow of outsiders seeking jobs and changes in population composition. The mining sites as well as farms neighbouring and en-route to the site are considered impact focal points. Safety and security impacts can range from burglary and/or armed robbery. The impacts are rated as likely. With the extensive range of practicable mitigation measures that can be implemented successfully the significance would reduce to moderate levels.

The following key recommendations are put forward, based on the results of the SIA:
- The project should go ahead on the conditions that, the developer must maintain frequent communication with the communities, taking into consideration the needs of different groups i.e. neighbouring land owners, community members;
- Local labour must be employed wherever possible;
- Engage the services of a Social Engagement Officer to ensure that social impacts are mitigated during construction and operation.

10.5.8 Heritage Impact Assessment

Reference is made to the Visual Impact Assessment attached as Annexure 3.7.

The specialist concluded that the assessment of the area was conducted successfully. In the surveyed area ten sites (Figure 27) of cultural significance has been found.

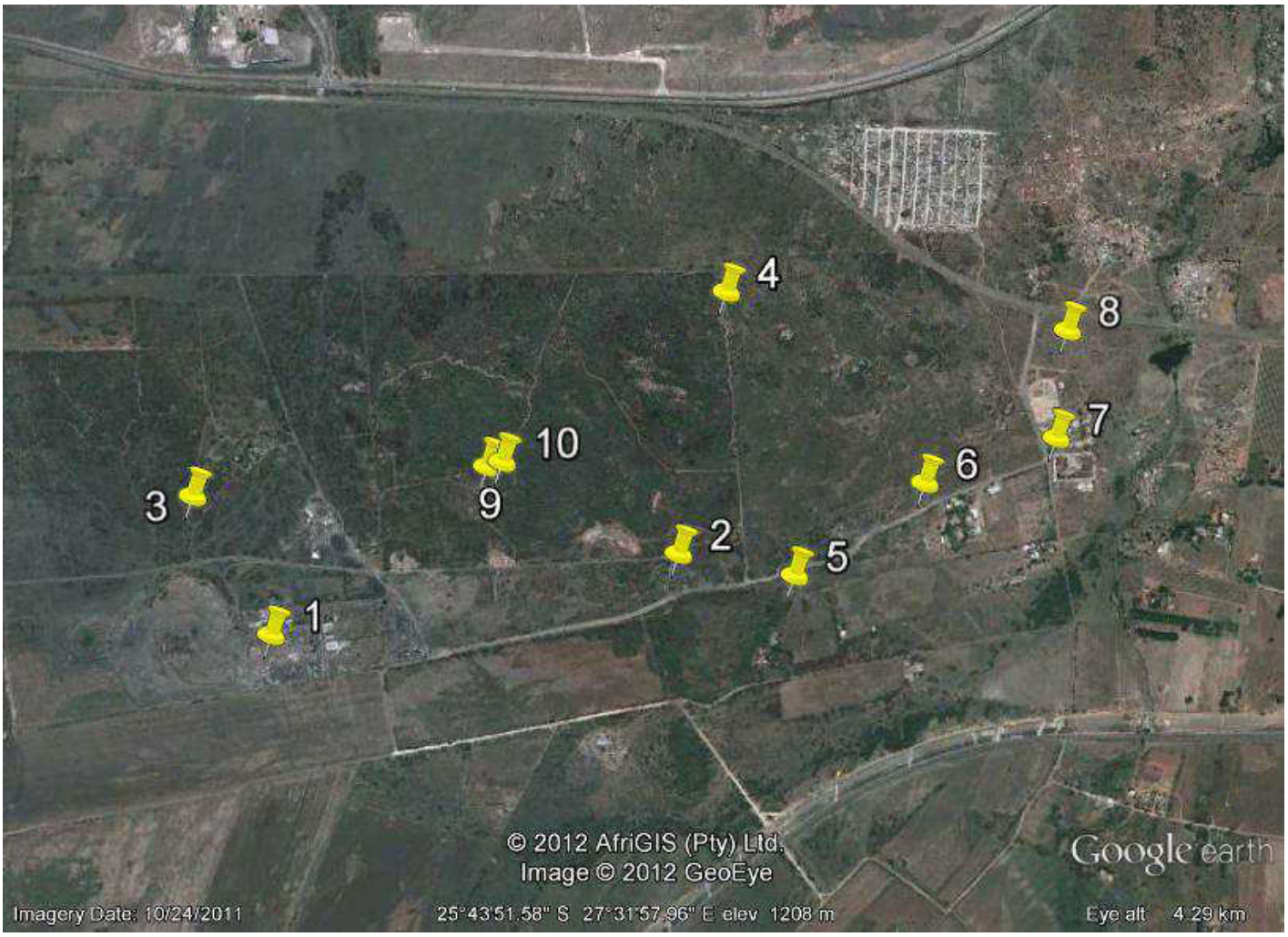


Figure 27: Google map indicating the sites located during the survey.

The final recommendations are as follows:

- Sites no. 1, 2, 3, 6 and 8 are within the area of direct impact and sites 4, 5, 7, 9 and 10 in the buffer zone (Figure 28);
- Site 1 and 2 may be demolished as it only has low heritage significance. Since the buildings are younger than 60 years, no further action is needed;
- Site 3 should be mitigated by drawing site maps thereof. After mitigation it may be demolished. For this a destruction permit should be obtained from SAHRA;
- Site 4 and 10 should be preserved as it does not need to be demolished since it falls within the buffer zone. It should be fenced in and a cultural heritage management plan should be drafted. The plan should be approved by SAHRA;
- Site 5 may be demolished, but only after it had been mitigated. This would include documentation thereof and acquiring a permit from SAHRA. However, since the site falls in the buffer zone it may be left as it is. The mine however needs to confirm the possibility of impact;
- Site 6 may be demolished, but a permit will be required from SAHRA before doing so;
- Site 7 and 8 should be left as it is, but should the need arise to demolish it, this may be done without a permit;
- Site 9 should also be left as it is. It may not be demolished;
- It should be remembered that due to the natural factors indicated in the report, it is possible that all cultural sites may not have been identified. Also the subterranean presence of archaeological and/or historical sites, features or artefacts are always a distinct possibility. Care should therefore be taken when development work commences that, if any more artifacts are uncovered, a qualified archaeologist be called in to investigate.

Figure 28: Google image indicating that sites no. 1, 2, 3, 6 and 8 are inside of the area of direct impact and the others in the buffer zone

10.5.9 Visual Impact Assessment

Reference is made to the Visual Impact Assessment attached as Annexure 3.8.

The construction and operation of the Samancor Elandsdrift mine related activities and its associated infrastructure will have a visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact can be reduce to a point where the visual impact can be regarded as insignificant.

The moderating factors of the visual impact of the facility in the close range are the following:

- Short exposure time of road users;
- Medium to Low sense of place that is created;
- Medium to high absorption capacity of the receiving environment;
- Number of human inhabitants located in the area;
- Visual exposure of human inhabitants located in the area;
- Natural topography and vegetation;
- Mitigation measures that will be implemented;
- Disturbed natural environment; and
- Anthropogenic environment created by mining, agricultural and other activities.

The visual impact is expected to be Medium before mitigation measures are implemented. In light of the above mentioned factors that reduce the impact of the facility, the visual impact is assessed as LOW VISUAL IMPACT after mitigation measures have been implemented.

The Visual Impact that will occur due to the mining activities and associated infrastructure can be seen as having Medium impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation has taken place, the visual impact can be seen as Low.

The visual impact that will occur from the mining activities can be sufficiently mitigated to a point where it can be seen as insignificant. Thus, mitigation measures are very important and one of the most significant mitigation measures are the rehabilitation of the area after mining has been concluded. If the rehabilitation of the impact is not done correctly and the final landform do not fit into the surrounding area, then the visual impact will remain high and thus become a concern. However, with correct rehabilitation, the impact will be minimal and there should be no visual impact after the landform has been restored.

Table 41: Overall assessment of the visual impacts

Nature of impact: The overall Assessment of the Visual Impact of the area.		
	No Mitigation	With Mitigation
	Proposed	Proposed
Extent	Regional (3)	Regional (3)
Duration	Medium term (3)	Short term (3)
Magnitude	Low (4)	Minor (2)
Probability	Likely (3)	Likely (3)
Significance Rating (SR)	Medium (30)	Low (24)
Status (positive, neutral or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impact be mitigated	Yes	
Mitigation:	The visual impact can be minimised by the creation of a visual barrier. The area will be rehabilitated after mining is concluded and thus the visual impact will be removed and the area will be restored.	

11. ASSUMPTIONS AND LIMITATIONS [REGULATION 31 (2) (m)]

- All information provided to the environmental team by the Applicant and I&APs was correct and valid at the time that it has been provided;
- The investigations undertaken by specialists during the EIA process, indicated that the development site is suitable and technically acceptable;
- It is not always possible to involve all I&APs individually, however every effort has been made to involve as many affected stakeholders as possible;

- The information provided by the Applicant and specialists was accurate and unbiased; and
- The scope of this investigation is limited to assessing the environmental impacts associated with the construction, operation and decommissioning of the proposed chrome mine.

12. REASONED OPINION OF THE EAP [REGULATION 31 (2) (n)]

Based on the findings of the EIA, the EAP is of the opinion that the proposed development be approved based on the extensive positive impacts it will have on the local and regional communities. These positive impacts include among others industry specific and general skills development programmes for the local community. This will result in social upliftment and will have a cumulative effect on the economy and social conditions of the population in the area. The potential negative impacts can be mitigated to acceptable levels and therefore are not a limiting factor in the approval of the environmental authorisation.

13. ENVIRONMENTAL IMPACT STATEMENT [REGULATION 31 (2) (o) (i-ii)]

The purpose of this report is to assess the identified potential impacts associated with the proposed development. Potential impacts were identified in consultation with I&APs, and through the technical expertise and experience of Environmental Assurance. The report sought to identify and assess the impacts of the proposed development on the biophysical environment and socio-economic status of the area and the probability of the impacts occurring. The proposed new chrome mine can pose various risks to the environment as well as the residents in the vicinity of the development, although these risks are likely to be limited in its extent.

PREFERRED ALTERNATIVE (CONSTRUCTION PHASE)

NATURE	DESCRIPTION OF IMPACT	POST-MITIGATION
Geological and Soils	Loss of topsoil and soil erosion through vegetation clearance, wind and stormwater.	Very low (-)
	Soil compaction by heavy duty vehicles	Low (-)
	Contamination of soils through: • Indiscriminate disposal of construction waste; and • Accidental spillage of chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles and other chemicals from construction activities e.g. paints.	Low (-)
Agricultural potential and land capability	Loss of soil resources for agricultural and other land uses.	Low (-)
	Possibility of "hot" work (e.g. welding) and workers causing veld fires destroying veld and loss of flora and fauna on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)
	Altered landforms due to construction of roads and excavation.	Very Low (-)
Existing Land Use of Surrounding Properties	Impact of blasting on existing infrastructure on surrounding land.	Low (-)

NATURE		DESCRIPTION OF IMPACT	POST-MITIGATION
Hydrology	Surface Water and Groundwater	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality during the construction phase.	Very Low (-)
		Contamination of stormwater runoff and groundwater, caused by: • Spills and leaks of cement; • Sediment release; • Chemical toilets; • Chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles; • Indiscriminate storage and disposal of hazardous waste; • Other chemicals from construction activities e.g. paints; and • Effluent discharges, due to a lack of stormwater management.	Very Low (-)
		Altered drainage patterns and stormwater runoff flows, especially due to vegetation clearance	Very Low (-)
		Dewatering of the groundwater aquifer.	Low (-)
Biodiversity	Flora and Fauna	Decrease in biodiversity on the study and surrounding area.	Low (-)
		Spill-over impacts, which may occur on adjacent ecological systems especially the sensitive riparian area.	Medium (-)
		Spreading of alien and invasive species	Low (-)
		Impact on natural migratory routes and faunal dispersal patterns.	Medium (-)
		Disturbance of fauna through noise, light and dust pollution and hunting, trapping and killing of fauna.	Low (-)
Archaeological/Heritage Resources		Potential for alteration of archaeological, historical and paleontological resources, should it be discovered during the construction phase.	Very Low (-)
Visual and Lighting		Visibility from sensitive receptors / visual scarring of the landscape as a result of the construction activities.	Medium (-)
		Visibility of solid domestic waste, building rubble and dust.	Very Low (-)
		Impact of security lighting on surrounding landowners and animals.	Very Low (-)
Noise and Vibration		Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the operation of construction vehicles and equipment.	Very Low (-)
		Disturbance due to vibrations caused by construction vehicles and blasting.	Very Low (-)
Air Quality		Increased dust pollution due to vegetation clearance as well as construction vehicles and activities.	Very Low (-)
		Settling of dust on the surrounding area and pasture for livestock may impact on livestock.	Very Low (-)
		Windborne dust (soil), vehicle fumes and stockpile particulate matter of PM_{10} and lower which alters air quality and pose a health risk.	Low (-)

NATURE	DESCRIPTION OF IMPACT	POST-MITIGATION
Waste (including hazardous materials)	Generation of additional general waste/ litter / building rubble and hazardous material during the construction phase.	Low (-)
	Indiscriminate disposal of waste could pollute natural resources and ecosystems and pose a risk of injury and death of animals and people.	Very Low (-)
Traffic	The change in the traffic patterns as a result of traffic entering and exiting the proposed mine on the surrounding road infrastructure and existing traffic.	Low (-)
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, busses and other heavy vehicles.	Low (-)
Health and Safety	Possibility of construction activities and workers causing veld fires, which can potentially cause injury and or loss of life to construction workers and surrounding landowners, visitors and workers.	Very Low (-)
	Increased risk to public health and safety: Dangerous areas and construction activities including blasting, pose health risks and possible loss of life to construction workers and visitors to the site.	Very Low (-)
	Security risks: Trespassing of construction workers on adjacent properties and possible crime.	Very Low (-)
	Spreading of diseases such as diarrhoea, HIV and TB.	Low (-)
Socio-economic	Creation of short term employment opportunities for the local communities, during the construction phase.	Medium (+)
	Sourcing supplies from local residents and businesses.	Medium (+)

PREFERRED ALTERNATIVE (OPERATIONAL PHASE)

NATURE	DESCRIPTION OF IMPACT	SIGNIFICANCE POST-MITIGATION
Geological and Soils	Loss of topsoil, soil erosion and soil compaction by heavy duty vehicles on site.	Very low (-)
	Contamination of soils through: • Indiscriminate disposal of waste; and • Accidental spillage of chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from vehicles and other chemicals from operational and maintenance activities e.g. paints.	Low (-)
	Flooding of opencast pit.	Low (-)
Agricultural potential and land capability	Possibility of "hot" work (e.g. welding) and workers causing veld fires destroying veld and animals on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)

NATURE		DESCRIPTION OF IMPACT	SIGNIFICANCE POST-MITIGATION
Existing Land Use		Blasting may disturb infrastructure on surrounding land.	Low (-)
Hydrology	**Surface Water and Groundwater**	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality during the operational phase.	Very Low (-)
		Contamination of stormwater runoff and groundwater, caused by: • Spills and leaks of cement; • Sediment release; • Chemical toilets; • Chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from mining vehicles; • Indiscriminate storage and disposal of hazardous waste; • Other chemicals from maintenance activities e.g. paints; and • Effluent discharges, due to a lack of stormwater management.	Very Low (-)
		Altered drainage patterns and stormwater runoff flows.	Very Low (-)
		Dewatering on the groundwater aquifer	Low (-)
		Acid Mine Drainage	Low (-)
		Seepage from product stockpiles and from mining operations could cause a contamination plume affecting the underground resources.	Low (-)
Biodiversity	**Flora and Fauna**	Decrease in biodiversity on the study and surrounding area.	Low (-)
		Spill-over impacts, which may occur on adjacent ecological systems.	Low (-)
		Spreading of alien and invasive species	Low (-)
		Impact on natural migratory routes and faunal dispersal patterns.	Medium (-)
Archaeological/Heritage Resources		Potential for alteration of archaeological, historical and paleontological resources, should it be discovered during the operational phase.	Very Low (-)
Visual and Lighting		Visibility from sensitive receptors / visual scarring of the landscape and impact on 'Sense of Place' as a result of the visibility of the mining site including stockpiles, waste dumps and activities.	Medium (-)
		Visibility of solid domestic, dust and operational waste.	Very Low (-)
		Impact of security lighting on surrounding landowners and animals.	Very Low (-)

NATURE	DESCRIPTION OF IMPACT	SIGNIFICANCE POST-MITIGATION
Noise and Vibration	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the operation of the mine.	Very Low (-)
	Disturbance due to vibrations caused by vehicles and blasting.	Low (-)
Air Quality	Increased dust pollution due to stockpiles and vehicles on gravel roads as well as other mining activities.	Very Low (-)
	Settling of dust on the surrounding area and pasture for livestock, may impact livestock.	Very Low (-)
	Windborne dust (soil and ore fines) as well as vehicle fumes and particulate matter of PM_{10} and smaller, altering air quality.	Very Low (-)
Waste (including hazardous materials)	Generation of additional general waste/ litter / building rubble and hazardous material during the operational phase.	Low (-)
	Indiscriminate disposal of waste could pollute natural resources and ecosystems and poses a risk of injury and death of animals and people.	Very Low (-)
Traffic	The change in the traffic patterns as a result of traffic entering and exiting the new mine, on the surrounding road infrastructure and existing traffic.	Low (-)
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, busses and other heavy vehicles.	Low (-)
Health and Safety	Possibility of mining activities and workers causing veld fires, which can potentially cause injury and or loss of life to mine workers and surrounding landowners, visitors and workers.	Very Low (-)
	Increased risk to public health and safety: Dangerous areas and mining activities including blasting, pose health risks and possible loss of life to mine workers and visitors to the site.	Very Low (-)
	Security risks: Trespassing of mine workers on adjacent properties and possible crime.	Very Low (-)
	Spreading of diseases such as diarrhoea, HIV and TB.	Low (-)
Socio-economic	Skills development for historically disadvantaged individuals (HDI's) and others from the local communities in the North West Province. Individuals will be more employable after the operational phase, which will benefit themselves, the workforce, the community and the economy.	Medium (+)
	Development and upliftment of the surrounding communities and infrastructure.	Medium (+)
	Development of the economic environment, by job provision and sourcing supplies for and from local residents and businesses.	Medium (+)

NATURE	DESCRIPTION OF IMPACT	SIGNIFICANCE POST-MITIGATION
	Creation of short to long term employment during all the phases of mining for local residents and skills transfer to unskilled and semi-skilled unemployed individuals.	Medium (+)
	Sourcing supplies from local residents and businesses.	Medium (+)

PREFERRED ALTERNATIVE (DECOMMISSIONING AND REHABILITATION PHASE)

NATURE		DESCRIPTION OF THE IMPACT	POST-MITIGATION
Geological and Soils		Loss of topsoil and soil erosion through vegetation clearance, wind and stormwater.	Very low (-)
		Soil compaction by heavy duty vehicles.	Low (-)
		Contamination of soils through: • Indiscriminate disposal of decommissioning waste; and • Accidental spillage of chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles and other chemicals from decommissioning activities.	Low (-)
Agricultural potential and land capability		Possibility of decommissioning and rehabilitation activities and workers causing veld fires destroying veld and animals on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)
		Restoring altered landforms due to excavation.	High (+)
Existing Land Use and Capability		Possibility of decommissioning and rehabilitation activities and workers causing veld fires destroying veld and animals on the study area and on adjacent farms, impacting on the livelihood of farmers.	Very Low (-)
Hydrology	Surface water and Groundwater	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality during the decommissioning phase.	Very Low (-)
		Contamination of stormwater runoff and groundwater, caused by: • Spills and leaks of cement; • Sediment release; • Chemical toilets; • Chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from construction vehicles; • Indiscriminate storage and disposal of hazardous waste; • Other chemicals from construction activities e.g. paints; and • Effluent discharges, due to a lack of stormwater management.	Very Low (-)

NATURE		DESCRIPTION OF THE IMPACT	POST-MITIGATION
		Altered drainage patterns and stormwater runoff flows.	Very Low (-)
		Impacts of dewatering on the groundwater aquifer should water be abstracted from groundwater during the decommissioning phase.	Low (-)
		Acid Mine Drainage.	Low (-)
Biodiversity	Flora and Fauna	Disturbance of fauna through noise, light and dust pollution and hunting, trapping and killing of fauna.	Very Low (-)
		Spreading of alien invasive species.	Low (-)
		Impact on natural migratory routes and faunal dispersal patterns.	Medium (-)
Archaeological/Heritage Resources		Potential for alteration of archaeological, historical and paleontological resources, should it be discovered during the decommissioning and rehabilitation phase.	Very Low (-)
Visual and Lighting		Visibility from sensitive receptors / visual scarring of the landscape as a result of the decommissioning and rehabilitation activities.	Medium (-)
		Visibility of solid domestic waste and building rubble.	Very Low (-)
		Impact of security lighting on surrounding landowners and animals.	Very Low (-)
Noise and Vibration		Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with heavy duty vehicles and equipment.	Very Low (-)
		Disturbance due to vibrations caused by construction vehicles.	Very Low (-)
Air Quality		Increased dust pollution due to construction vehicles and decommissioning activities.	Very Low (-)
		Settling of dust on the surrounding area and pasture for livestock, may impact livestock.	Very Low (-)
		Windborne dust (soil), vehicle fumes and particulate matter of PM_{10} and smaller, altering air quality.	Very Low (-)
Waste (including hazardous materials)		Generation of additional general waste/ litter / building rubble and hazardous material during the decommissioning phase.	Low (-)
		Indiscriminate disposal of waste could pollute natural resources and ecosystems and pose a risk of injury and death of animals and people.	Very Low (-)
Services Water, Sewage, Electricity		Need for services i.e. water, electricity and sewerage systems during the decommissioning phase causing additional strain on natural resources.	Medium (-)
Traffic		The change in the traffic patterns as a result of traffic entering and exiting the proposed mine on the surrounding road infrastructure and existing traffic.	Low (-)
		Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, busses and other heavy vehicles.	Low (-)

NATURE	DESCRIPTION OF THE IMPACT	POST-MITIGATION
Health and Safety	Possibility of when 'hot' work is done (e.g. welding) and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	Very Low (-)
	Increased risk to public health and safety: Dangerous areas and decommissioning activities pose health risks and possible loss of life to construction workers and visitors to the site.	Very Low (-)
	Security risks: Trespassing of workers on adjacent properties and possible crime.	Very Low (-)
	Spreading of diseases such as diarrhoea, HIV and TB.	Low (-)
Socio-economic	Creation of short term employment opportunities for the local communities, during the decommissioning phase.	Medium (+)
	Sourcing supplies from local residents and businesses.	Medium (+)

NO-GO ALTERNATIVE

NATURE	DESCRIPTION OF THE IMPACT	POST-MITIGATION
Socio-economic	No skills development for historically disadvantaged individuals (HDI's) and others from the local communities in the Northwest Province. Individuals will be more employable after the operational phase, which will benefit themselves, the workforce, the community and the economy.	Medium (+)
	No development and upliftment of the surrounding communities and infrastructure.	Medium (+)
	No development of the economic environment, by job provision and sourcing supplies for and from local residents and businesses	Medium (+)
	No creation of short to long term employment during all the phases of mining for local residents and skills transfer to unskilled and semi-skilled unemployed individuals.	Medium (+)
	No negative impacts on the biophysical and socio-economic environment	Very High (+)

14. RECOMMENDATIONS [REGULATION 31 (2)]

Our recommendation, based on the information currently available, is that the application for the proposed development should continue, and that the Applicant be allowed to investigate the establishment of the chrome mine. This authorisation should be in line with sensitive planning, design and good environmental management. If the concept of sustainable development is considered it is proposed that the mine will have a positive impact on the provision of social and economic criteria. With the recommended guidelines provided by the various specialists' studies; the ecological component can also be brought into balance. In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are

implemented through physical measures, the recommendations from the EIA are included within the EMPr which should form part of the contract with the contractors appointed to construct and maintain the proposed development. The EMPr would be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases (i.e. construction, operation and decommissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

It is also recommended that the EMPr, attached as Annexure 8 be approved. The EMPr is based on all the information contained in this report as well as all the specialists' reports. It is recommended that the conditions of the Environmental Authorisation include that an independent Environmental Control Officer (ECO) should be appointed by the Applicant to monitor the implementation of the EMPr through the site establishment and construction phase, the operational, decommissioning and rehabilitation phases. The ECO should also compile audit reports to be provided to the Applicant for submission to the CA. Audit reports should be submitted on a monthly basis during the site establishment and construction phase as well as the decommissioning phase. During the operational phase audit reports should be submitted quarterly. It is imperative that all mitigation measures provided in the specialists' reports, this Environmental Impact Assessment Report as well as the Environmental Management Programme be implemented and strictly monitored. If the concept of sustainable development is considered it is proposed that the chrome mine will have a positive impact on the provision of social and economic criteria. With the recommended guidelines which would be provided by the various specialists' studies; the ecological component can also be brought into balance.

15. ANNEXURES [REGULATION 31 (2)]

Annexure 1: Maps and design layouts
Annexure 2: Authority Correspondence
Annexure 3: Specialists Reports
Annexure 3.1: Soil and Land Capability Assessment
Annexure 3.2: Geohydrological Impact Assessment
Annexure 3.3: Surface water Impact Assessment
Annexure 3.4: Ecological Impact Assessment
Annexure 3.5: Bio monitoring Impact Assessment
Annexure 3.6: Social Impact Assessment
Annexure 3.7: Heritage Impact Assessment
Annexure 3.8: Visual Impact Assessment
Annexure 3.9: Traffic Impact Assessment
Annexure 4: Mining Works Program
Annexure 5: Social and Labour Plan
Annexure 6: Public Participation
Annexure 7: Impact Assessment Table
Annexure 8: Environmental Management Program

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