Environmental Impact Assessment Report and Environmental Management Plan

Northern Coal Weltevreden

Northern Coal (Pty) Ltd

MP 30/5/1/2/2/385 MR

August 2009

Revised March 2010

DWA

Environmental Solutions Provider

PROJECT DETAILS

Name of project:	**Weltervreden**
DMR refrence no.:	**MP 30/5/1/2/2/385 MR**

Applicant:

Name of Applicant:	Northern Coal (Pty) Ltd
Contact Person:	Mr G. W. Middup
Postal Address:	P. O. Box 52651, Saxonwold, 2132
Telephone No.:	(011) 882 7204
Fax No.:	(011) 882 9044

Environmental Consultant:	**Digby Wells & Associates (Pty) Ltd**
Contact Person:	Louise Nicolai
Postal Address:	Private BagX1046, Randburg, 2125
Telephone No.:	(011) 789 9495
Fax No.:	086 524 0711

This document has been prepared by **Digby Wells & Associates (Pty) Ltd** © 2009

Name	Responsibility	Signature	Date
Louise Nicolai *EAP*	Report Writer		
Johan Hayes *Dept Manager*	1st Review		
External Reviewer	2nd Review		

.

EXECUTIVE SUMMARY

Northern Coal (Pty) Ltd (Northern Coal) submitted a Mining Right Application (MRA) to mine coal on portions 15 and 16 of the farm Weltevreden 381 JT within the Belfast area of the Mpumalanga Province, was been accepted by the Department of Mineral Resources (DMR). Through the results of feasibility studies, together with the demand for coal within the internal and international market, Northern Coal has found it economically viable to undertake mining operations on the above mentioned portions.

Digby Wells and Associates (Pty) Ltd (DWA) have been appointed by Northern Coal as independent environmental consultants to undertake the environmental investigations and document compilation required by the various governmental departments in support of the MRA and to obtain environmental authorisation for the proposed project.

Northern Coal (Pty) Ltd must be in possession of an approved Mining Right for the mining of coal on portions 15 and 16 the Farm Weltevreden 381 JT before mining operations may commence. In terms of the MPRDA various supporting documentation is required for the proposed project as part of the application for a Mining Right.

The Northern Coal Weltevreden Project involves the opencast mining of the No. 2 Seam of the Witbank coal field. The seam thickness varies from 1.2m in the north section of the mining area to 4.15m in the south west portion.

The mining method that will be undertaken in order to remove the coal seam will be truck and shovel roll-over method. An estimated 187.51ha will be disturbed which equates to approximately 38% of the total project area as this is in line with the available coal reserve on the proposed project area. The opencast mining will be undertaken in three phases, or sections, which will result in the coal resource to be mined through three consecutive pits.

The total Run of Mine (ROM) coal to be extracted is estimated at 7.512Mt during the Life of Mine (LOM) of approximately 7 years.

The main areas of concern or issues that have arisen from the consultation process with the Interested and Affected Parties (I&APs) with regards to the proposed Weltevreden Project are provided below:.

Issue/Impact
Air Quality and Dust: Wind-blown dust as a result of construction activities and establishment of surface infrastructure. Impacts of coal dust on agricultural crops and forestry plantations will hinder photosynthesis process and reduce crop quality. Dust emissions resulting from demolishing of infrastructure and clearing of the site will impact on neighbouring residents and agricultural crops.
Surface Water (Quality & Quantity): Compromising the quality of surface water necessary for agricultural activities. Polluted surface water resources must be restored/rehabilitated.
Groundwater (Quality): Compromising the quality of groundwater necessary for agricultural activities and residential purposes. Polluted groundwater resources must be restored/rehabilitated.
Groundwater (Quantity): Compromising the quantity of groundwater necessary for agricultural activities and residential purposes. Damage to boreholes as a result of blasting and dewatering.
Noise: Construction activities will have noise impacts on neighbours - reverse hooters, construction vehicles. Operational activities will have noise impacts on neighbours - reverse hooters, operation of the crushing plant, trucks. Noise associated with closure activities will impact on neighbouring farms and residents.
Traffic and Roads: Increase in construction vehicle traffic on local roads, creating safety hazards for residents and farmers in the area. Damage to local roads from heavy trucks.
Loss of Agricultural Land: Agricultural land will be lost with the construction of surface infrastructure. Agricultural land will be lost as a result of the mining operation. Agricultural land will be lost for the purposes of undertaking agricultural activities, especially cropping.
Soil and Land Capability:

The soil characteristics of the development site will be altered by the time the decommissioning phase commences.
Sustainability: The area is better suited for agricultural activities than it is for mining.
Visual: Construction of surface infrastructure, operation and decommissioning of the mine will be visible to landowners in the area, specifically neighbouring farms.
Socio-Economic: Employment opportunities will be created.
Health and Safety: The commuting of workers onto neighbouring properties may pose safety risks.
Fauna & Flora: The mining development will alter the biodiversity of the area.
Blasting: Damage to structures surrounding the mining site as a result of vibrations and air blasts associated with blasting.

The following table briefly describes the significant impacts that could result from the proposed Weltevreden project. These have been described in detail in this report.

Environmental impact assessment	
Topography	Alteration to topography from opencast pits and rehabilitation will have a negative impact of medium significance.
Geology	Disturbance to the geological sequence and removal of coal. This is a permanent impact and mitigation is not possible.
Soil	Increase in erosion potential to soils from surface disturbance and vegetation removal, results in loss of topsoil. Loss of the natural soil structure and soil properties from handling and contamination.
Surface water	Acid mine drainage (AMD) could result in the deterioration of surface water resources after closure.
Groundwater	The establishment of a box cut may dewater the surrounding aquifers. Acid mine drainage (AMD) could result in deterioration of groundwater resources.

Environmental impact assessment	
Sensitive landscapes	The opencast areas will result in the destruction of habitats. A buffer zone will be required around the wetland areas and aquatic ecosystems to minimise/prevent impacts on them. Modification of hydrological processes will occur in areas where dewatering will take place.
Regional socio-economic structure	Positive impacts are expected in terms of employment, skills development, regional spending, and contribution to taxes, implementation of the Social and Labour Plan and the continuous supply of coal to Eskom to ensure electricity generation.

The EMP has been described according to the project activities in order to provide an understanding of what objectives and recommended management measures are required to minimise the environmental, socio-economic and cultural/heritage impact arising from these activities.

The financial provision was calculated using the DMR rates. The costs calculated for the financial provision for the first year of operation is **R1,931,079.49 (one million, nine hundred and thirty one thousand and seventy nine rand and forty nine cents).** In the first year the initial cut will be established and a number of strips will be established before rehabilitation of the initial cut is initiated.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLANS

APPENDICES

ABBREVIATIONS

Acronym	Description
ABA	Acid-base accounting
AIA	Archaeological Impact Assessment
AMD	Acid mine drainage
BIDs	Background Information Documents
BPG	Best Practice Guidelines
Ca	Calcium
CBOs	Community Based Organisations
dBA	A-weighted decibels
DMR	Department of Mineral Resources
DTM	Digital Terrain Model
DWA	Digby Wells & Associates
DWEA	Department of Water and Environmental Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ELM EMF,	Emakhazeni Local Municipality Environnemental Management Framework
EMP	Environmental Management Programme
GG	Government Gazette
GN	Government Notice
GIS	Geographic Information System
GV	Ground Vibration
g/t	grams per tonne
ha	hectare
I&APs	Interested and Affected Parties
K	Potassium
ktpm	kilo tonnes per month
kV	kilo Volts
l/s	Litres per second

Acronym	Description
LoM	Life of Mine
m^3/d	Meters cubed per day
Mm^3	Million cubic meters
m.a.m.s.l.	meters above mean sea level
MAP	Mean Annual Precipitation
MDALA	Mpumalanga Department of Agriculture and Land Administration
mbgl	Meters below ground level
Mg	Magnesium
Ml	Mega litres
MPRDA	Minerals and Petroleum Resources Development Act, No. 28 of 2002
MRA	Mining Right Application
mS/m	millisiemens per meter
Mt	Mega tonnes
NEMA	National Environmental Management Act, No.107 of 1998
NEMA:AQA	National Environmental Management Air Quality Act, No39 of 2004
NEMBA	National Environmental Management Biodiversity Act, No 10 of 2004
NEMWA	National environmental Management Act, No. 59 of 2008
NGOs	Non-Governmental Organisations
NHRA	National Heritage Resources Act, No. 25 of 1999
Northern Coal	Northern Coal (Pty) Ltd
PPP	Public Participation Process
RBDM	Risk Based Decision Making
ROM	Run of Mine
SAWS	South African Weather Service
SLP	Social and Labour Plan
WRC	Water Research Commission

1 INTRODUCTION

1.1 BACKGROUND

Northern Coal (Pty) Ltd (Northern Coal) has submitted a Mining Right Application (MRA) to mine coal on portions 15 and 16 of the farm Weltevreden 381 JT within the Belfast area of the Mpumalanga Province, which has been accepted by the Department of Minerals (DM). Through feasibility studies, together with the demand for coal within the internal and international market, Northern Coal has found it economically viable to undertake mining operations on the above mentioned portions.

Digby Wells and Associates (Pty) Ltd (DWA) have been appointed by Northern Coal as independent environmental consultants to undertake the environmental investigations and document compilation required by the various governmental departments in support of the Mining Right Application and to obtain environmental authorisation for the proposed project.

Northern Coal proposes to undertake opencast mining of the No 2 Coal Seam of the Witbank Coal Field. The extracted coal will be crushed and supplied directly to Eskom via road haulage.

1.1.1 Regional setting

The Northern Coal Weltevreden Project in located within the Witbank coal field 25km south of Belfast in the Mpumalanga Province. The location of the project area can be seen on (Plan 1). The project area falls within the Emakhazeni (Highlands) Local Municipality and the Nkangala District Municipality. The mining site of portion 15 & 16 of the farm Weltevreden is accessible from the R 33 towards Belfast which links to the N4. Site co-ordinates are 25˚43’0”S: 30˚03’0”E.

1.1.2 Land tenure

The mining activities of the Northern Coal Weltevreden Project will be undertaken on portions 15 and 16 of the Farm Weltevreden 381 JT which is a total of 513.8ha in size. Table 1 below gives the land owner information of these two portions and the following table gives the information of the adjacent land owners to the operation. The location of all the farms and landowners motioned below can be seen on Plan 2.

Table 1: Landowner details of the project area

Farm Name	Portion	Landowner
Weltevreden 381 JT	15	Mr W Pretorius
Weltevreden 381 JT	16	Mr W Pretorius

Table 2: Adjacent landowners to the Weltevreden Project

Farm Name	Portion	Landowner
Weltevreden 381 JT	2	Mr W Pretorius
Weltevreden 381 JT	9	Sameul Johannes Lundall
Weltevreden 381 JT	RE	Sameul Johannes Lundall
Zoekop 426 JS	10	Highlands Organics
Weltevreden 381 JT	4	André Viljoen
Blyvooruitzicht 383 JT	16	Willem Pieter Pretorius
Blyvooruitzicht 383 JT	17	Jozef Benjamin Kotzé

There are no registered land claims on portions 15 and 16 of the farm Weltevreden 381JT. The confirmation from the department is attached in Appendix B.

Plan 1: Regional Setting

Plan 2: Land Tenure

1.2 PROJECT MOTIVATION

Globally coal is the fastest growing energy source. The Energy Information Association reports that world coal consumption will almost double in the period 2003-2030, with the forecast suggesting that the Chinese and Indian markets will remain a driver in these consumption figures (Mining Weekly, 5 December 2008: Favourable coal prices increase producer's presence in the power station coal export market).

Whilst the South African Government is committed to seeking new and alternative energy sources (White Paper on the Renewable Energy Policy of South Africa, November 2003), the demand for energy globally will result in coal continuing to play an important role in the energy supply mix in the foreseeable future.

Changes in the global market is placing State-owned power utility, Eskom under increasing risk in terms of securing future supplies from the local market, in which the production capacity has not kept pace with increases in both local and international demand (Eskom, 2008).

According to the Eskom Annual Report (2008) there is great concern that the low growth of coal production occurring in South Africa may pose a serious supply risk to Eskom and South Africa. If no intervention occurs, South Africa may face an annual coal shortage of 100Mt by 2017.

The Northern Coal Weltevreden Project involves the mining of a low grade coal resource that is suitable for Eskom. The total ROM coal to be extracted is estimated at 7.512Mt during the LoM of approximately 7 years

Northern Coal's approach to sustainable development and the benefits of the project can be summarised as follows:

- The Weltevreden Project will be supplying Eskom exclusively to meet its domestic coal demand and thereby supporting the security of energy supply to South African citizens;
- Coal from Weltevreden will be supplied directly to Eskom. This can be seen as a benefit as no beneficiation, discard dump or slimes disposal facility will be required therefore reducing the operation impact on both the receiving and surrounding environment;

- A Social and Labour Plan (SLP) as part of the Mining Right Application (MRA), was developed in accordance with the SLP guidelines as provided by the DM. Through the implementation of the SLP, Northern Coal will invest in social capital and promote sustainable local economic development in the surrounding area; and
- Weltevreden will employ 45 personnel in an area where the mining sector only contributes 6.1% to employment.

1.3 PROJECT ALTERNATIVES

The following are alternatives that have been considered and evaluated.

1.3.1 Coal Resource Alternative outside Mpumalanga

The coal resource to be mined, as part of the proposed Weltevreden project, is located within the Witbank coal field. The Witbank coal field is part of the Central Basin coal reserves which falls predominantly within the Mpumalanga province. This area is the central supply area for the Eskom power stations in the vicinity. Mining of low grade coal, that meets Eskom specification, is required in order for Eskom to meet increasing power demands across the country. In terms of resource alternatives outside of Mpumalanga, the Waterberg coal field is becoming an important future resource for coal requirements in order to meet demand. Currently this resource holds constraints into being considered as an alternative resource site. The Waterberg coalfield lies far from the industrial centres of the country and lacks significant infrastructure for its development. However, as Eskom expands operations in the Waterberg, this area will need to be considered more closely as a future resource alternative. As Eskom commissions the construction of new power stations in the region it would act as a catalyst for further development as there would be an ensured market for the low grade coal situated close to the coal reserve.

1.3.2 Mining alternatives

The nature of the coal seams determines the preferred mining method of opencast mining. The location of the feasible coal determines the location of the mining operation. These two factors limit mining alternatives that are available. The only possible alternative available will be the no-mining option.

The depth to coal does not allow underground mining to take place. The No. 2 seam is the only seam on the property of economic value. The tonnage of the resource and the life of mine will indicate the optimal mining rate; this in turn will inform the mining method. Drag line operations, or large scale mining will not be feasible.

1.3.3 Land use alternatives

When considering the allocation of land for development and in deciding applications for planning permission affecting agricultural land, the agricultural implications must be considered together with the environmental, cultural and socio-economic aspects. In particular, prime quality land should normally be protected against permanent development or irreversible damage.

Consideration of land use alternatives is one of the cornerstones of community planning. Land use decisions must be evaluated in terms of sustainability, broadly defined as balancing environmental, economic and social equity concerns. The primary land use categories that encompass basic functions are residential, commercial, industrial, recreational, institutional, and agricultural uses. Land use is determined by a number of factors. These include climate, resources, population growth, economic activity and topography. When considering a new development for an area, it is required that other land use alternatives are considered to ensure that the development is justified and viable.

In the project area, present land uses includes agriculture (crop and grazing), residential, business and recreational. In terms of the Weltevreden Project, the current land use is agriculture. The remaining extent of the property that is not been utilised for agricultural production is currently been used for additional agricultural purposes such as grazing. Alternatively the land may be returned to its natural status which may hold possible eco-tourism benefits, however due to the adjacent land predominantly being used for agricultural purposes eco-tourism in the area is an unlikely option.

Stock farming and cropping are the most suitable land use on the site apart from coal mining.

Alternative agriculture could also be an option for alternative land use. This may include cherry orchards, planting of potatoes and the implementation of organic farming methods. Orchards will have a reduced impact on the land however it will still require clearing of land and the use of fertilizers and herbicides. Orchards may also take approximately five years before they become economically productive. Through the use of organic farming methods this will reduce possible impacts that will result from the agricultural activities.

Agriculture, in the form of crop production and grazing, can impact negatively, to some degree, on the environment. Agriculture does, however, provide a food source for communities. Mining will have an impact on the environment but the benefits of mining include social upliftment, provision of jobs, earning of foreign currency and local economic development. However, currently the majority of the population in the area is employed are agriculture and not in mining activities.

1.3.4 Mining development and infrastructure alternatives

The mine planning has taken into consideration alternative opencast development and process of mining the coal. The alternative to one extensive pit is to mine the reserve in three pits which will allow for the preservation of the stream that cuts through the opencast area. An infrastructure alternative is to have temporary required facilities on site which reduces the impact on the receiving environment from infrastructure development. The dismantling and removal of temporary facilities at closure will have a lesser impact than permanent concrete structures.

1.3.5 No-mining option

The current land use is one of 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, such as increased employment of residents in the area, greater economic input into the area allowing better development of the towns and surrounding areas, and greater socio-economic stability in the area. After mine closure and rehabilitation of mined areas, the land capability may return to a state that allows the continuance of 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.

Not mining the coal reserves available on Weltevreden will prevent the use of a coal reserve for the generation of electricity at a time where a much-publicised inability to generate enough electricity to sustain economic growth exists.

Northern Coal will furthermore lose their rights to mine the coal to the State, rights in which they have invested extensive time and resource, and as the resource can be economically mined additional applicants will in all likelihood apply for the mineral rights on the property.

2 COMPLIANCE WITH SECTION 39(4)(A)(I)

2.1 SECTION 39(3)(A)

"Establishment of baseline information concerning the affected environment to determine protection, remedial measures and environmental management objectives"

2.1.1 Baseline information

2.1.1.1 Climate

The area is characterised by moderate summers, cold winters and summer rainfall. The average rainfall in the target area is 768 mm per annum. The rainfall distribution and total rainfall is typical of the Highveld region. The region is characterised by thunderstorms in the summer. Temperatures are also typical of what could be expected in the Highveld region, although lower temperatures could be expected on the high flying regions (ELM EMF, 2006).

Climate data describing a local area is not always easy to obtain since the South African Weather Service (SAWS) does not have observation stations in all possible areas. Data from observation stations is not only important due to locality, but also periodically as one has to consider the 30 year accepted standard of observed record. When searching for climate data describing a particular local setting both the locality and the length of the time series of the data are taken into consideration. Different data manipulation techniques such as rainfall patching exist in order to make up for the lack of or the unevenly spreading of data stations. These techniques are however not always feasible or affordable for a specific area and one has to describe the climate with the available resources at hand. One of these resources is the six Water Research Commission (WRC) documents which describe distribution of rainfall over South Africa on a quaternary catchment level. These documents are commonly used in many disciplines of environmental management and are a very good reference to specific climate characteristics such as rainfall.

Climate data from the SAWS was obtained for the station of Belfast weather station (05170412) which is approximately 7km from the study area. The data time series of this station only consists of a three year record period which stretches from 2005 to 2007. No other suitable observation stations could be located in order to assist in the climate description. Hence, Volume VI of the WRC documents was used as a reference to assist in describing the climate of the area.

Mean rainfall and precipitation

The Mean Daily Precipitation (MDP) according to the Belfast observation station is 45mm (Figure 1). The Mean Annual Precipitation (MAP) of the area is 744mm with the highest concentration of rainfall been experienced between November and February (WRC Report NO 298/6.1/94). According to Emakhazeni Local Municipality (ELM) Environmental Management Framework (EMF), the average rainfall in the target area is 768 mm per annum. The winter months contribute very little to the annual rainfall amount experienced in over the study area.

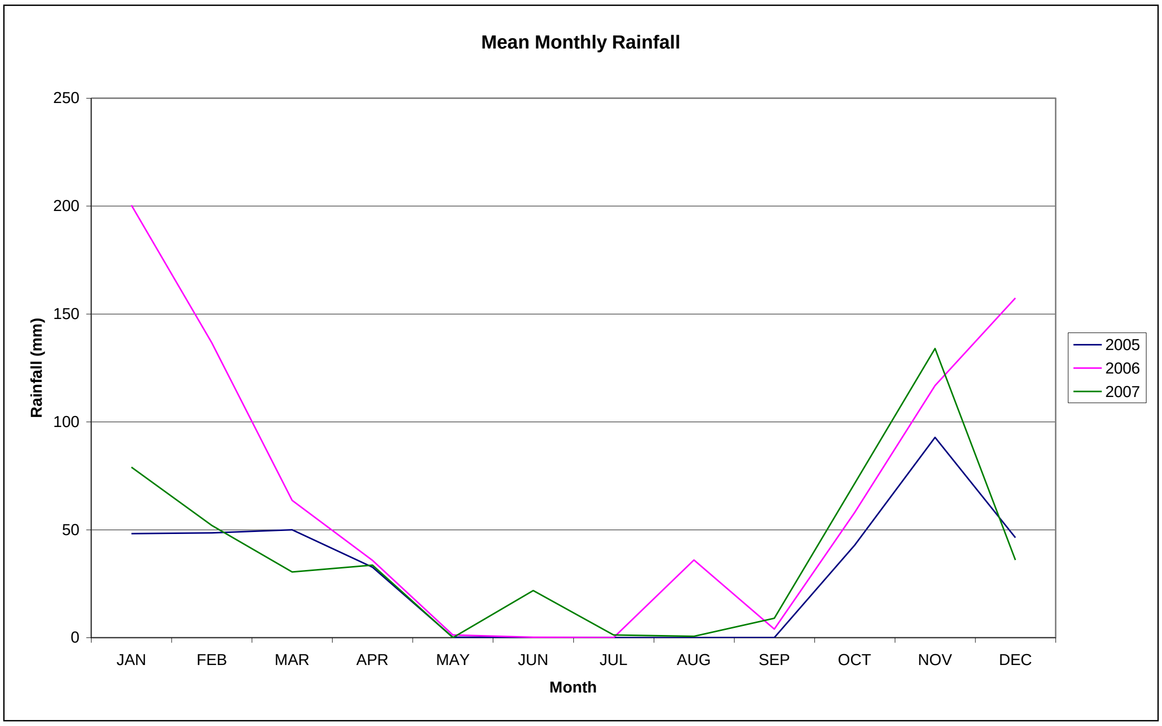


Figure 1: Mean annual rainfall for Belfast.

Mean monthly temperatures

The area of Belfast experiences an average daily maximum temperature of 21ºC. Temperature variations are experienced with seasonal changes with the average summer maximum temperature of 25˚C which drops to 15˚C during the winter months. The minimum temperatures in the area can drop to below 0˚C during the winter months. Figure 2 illustrates the mean monthly maximum and minimum temperatures recorded at the Belfast weather station.

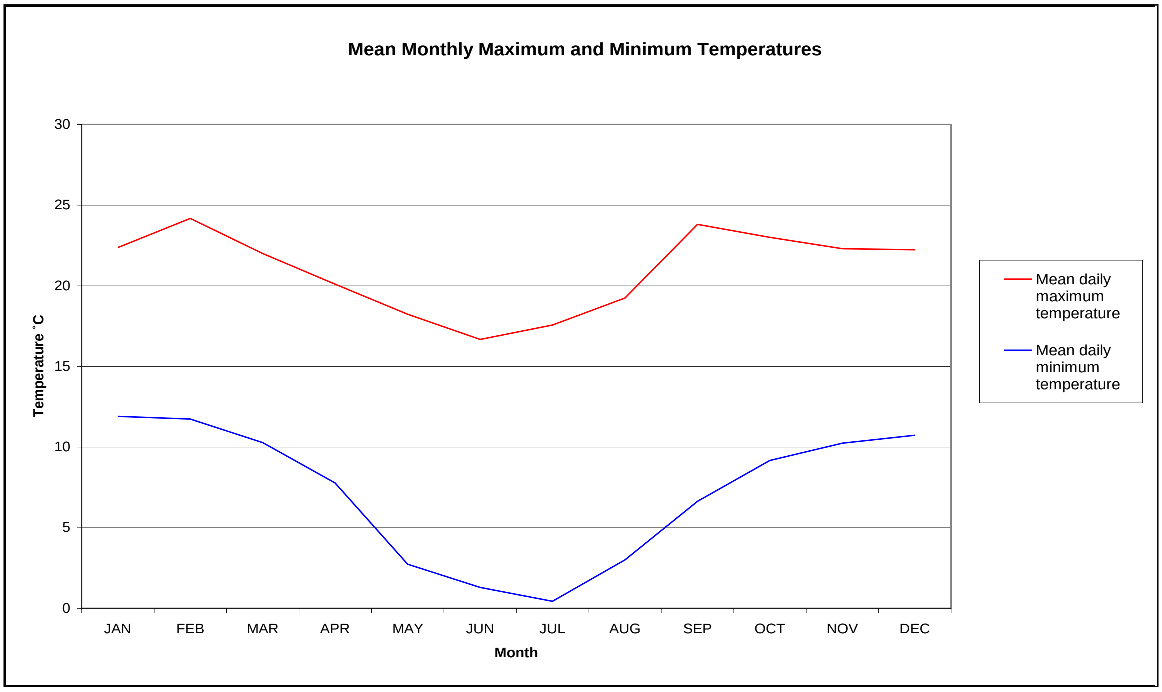


Figure 2: Mean monthly temperature for Belfast weather station

Mean annual wind direction

Figure 3 indicates the average annual wind direction and speed from 2005-2007 for the Belfast climate station. From the graph below it is clear that the predominant wind direction in the area is north-easterly. According to the available data series only a small percentage of wind speeds experienced in the area exceed 5.6m/s. According to monthly averages obtained from the Belfast time series July is the windiest month. More extreme wind events have and can however occur over the region as information obtained from locals suggests. Data from the Rietvallei (SAWS) observation station which is situated approximately 9.5km from the study area was obtained from a local land owner in the area. The time series of this data covers a total period of seven years which stretches from 1993 up to 2000. According to this data time series shown in Table 3 maximum wind gusts have reached speeds of up to 45km/h (13m/s).

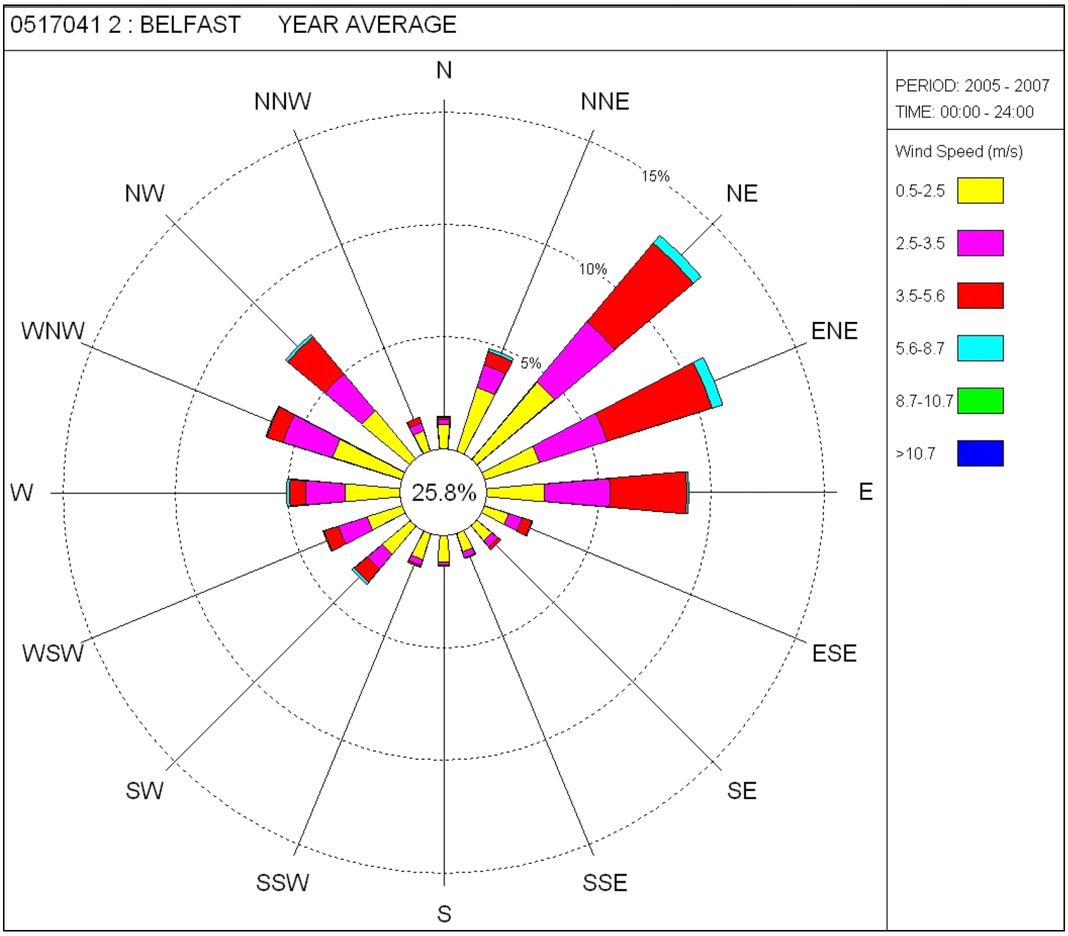


Figure 3: Average annual wind direction and speed for Belfast Weather Station.

Table 3: Average wind speeds measured in km/h at Reitvallei Weather Station.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1993	0.00	0.00	24.03	34.69	37.10	35.63	36.16	38.33	45.28	27.06	36.35	38.54
1994	37.08	33.90	34.40	33.26	31.49	42.91	39.57	40.97	42.56	50.57	29.41	45.59
1995	39.93	36.04	40.76	42.59	35.81	33.68	38.00	42.43	40.84	52.32	43.87	39.10
1996	43.08	39.51	29.30	35.11	31.42	34.79	40.74	43.56	43.76	45.67	44.29	36.93
1997	44.06	39.06	37.77	34.14	34.49	37.32	34.28	35.81	41.62	45.75	46.92	41.62
1998	42.38	36.89	37.37	36.90	39.81	31.70	33.29	37.22	43.45	41.78	41.50	42.89
1999	39.24	41.46	38.98	38.28	35.65	35.00	35.28	36.99	41.93	43.18	41.68	14.31
2000	37.37	0.00	35.21	31.76	29.16	31.75	34.12	31.38	28.36	36.28	38.16	36.20
AVE	41.01	38.59	36.26	36.01	33.98	35.31	36.47	38.34	40.36	45.08	40.83	36.66

2.1.1.2 Topography

Topography is defined as the study of the earth's surface features and involves predominantly the relief of the surface, vegetation cover and human activities. The topography has a strong relationship with the underlying geology and climate; thus there is a strong link between topography and the science of geomorphology. One of the objectives of topography is to describe spatial relationships in terms of relative position, both horizontally and vertically. This section will focus more on the relief of the topography and the associated impacts that the proposed development will have on the topography. Various geographic tools can be utilized in assessing the relief aspect of topography; these include contour lines which can be manipulated using a Geographic Information System (GIS) to form a Digital Terrain Model (DTM) which illustrates the relief of the land very effectively. The DTM can be further manipulated to form a three dimensional (3D) view of the terrain. Further to this, aerial imagery is also used which greatly assists in the description of the surface. The aerial imagery can be draped over the DTM to enhance the effect of the topographical relief model.

The site is located on the southern side of a major ridge; this is evident on Plan 4. This ridge forms part of the primary catchment area boundary (watershed) of the Komati River. The site is located approximately 2.5km from this watershed and is near the periphery of the catchment area at a high elevation (and at the source of the streams). This fact is important for surface water issues, as any polluted surface water on the site has the potential to pollute a lengthy and important river system. On the site itself, the altitude varies between 1880m above mean sea level (m.a.m.s.l.) at the highest point and 1795m.a.m.s.l. at the lowest point, thus there is a range of 85m between the highest and lowest points. This is further translated into an average gradient on the site of 4%. The site is located in the X11D quaternary catchment area which has an average slope of approximately 6%, thus the average slope on the site is gentler than the average slope of the quaternary catchment area in which it is located.

Figure 4 below depicts the Digital Terrain Model (DTM) three dimensionally; which illustrates the topography of the site relative to the surrounding areas. The Weltevreden site boundary is drawn as a black border and the proposed open cast pits are shaded in grey. It can be seen that the general direction of the slopes dips to the south-west on the site which is further substantiated by Figure 5 which is a photo taken on site in a north-westerly direction.

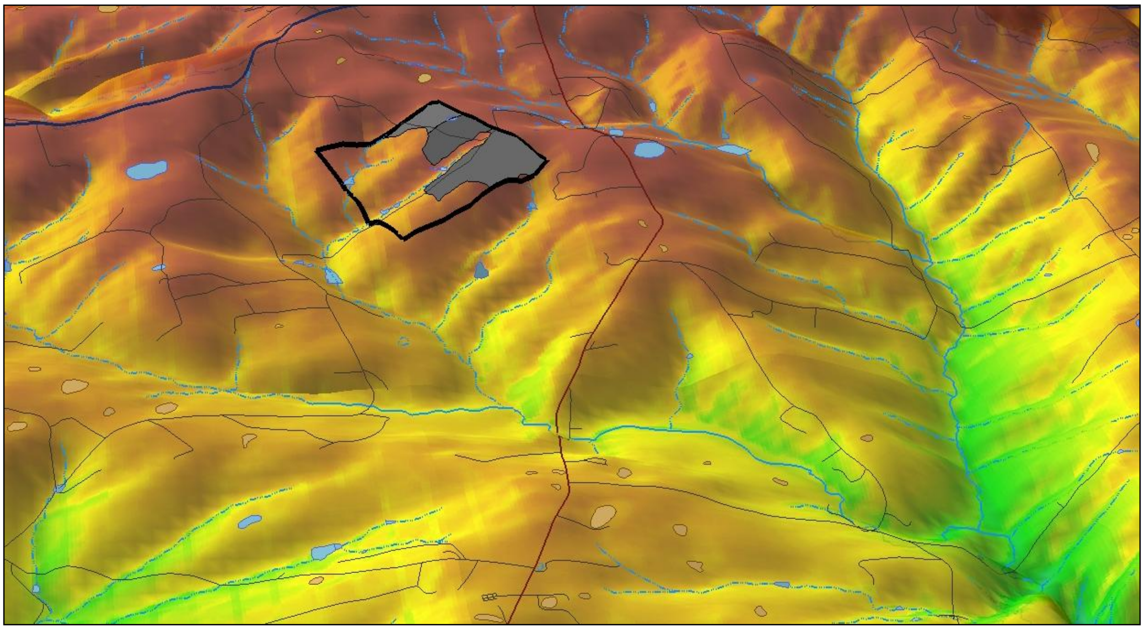


Figure 4: 3D DTM of Weltevreden site relative to surrounding area depicting spurs, valleys, relative elevation and drainage lines.

Figure 5: Photo on site taken in a north-westerly direction. Note the south-western dip of the slopes.

Plan 3: Topographical map

To locally illustrate the topography on the site, the aerial imagery of the site was draped of over the DTM to create the model below which displays the site as viewed in a north-easterly direction. The Weltevreden site is outlined with a black line and the proposed open cast pits are delineated using a red line. It is evident that the site itself is made up of three spurs, and thus it influences water drainage into three different streams which eventually converge and travel southwards towards the Komati River. The site itself does have some agricultural activity taking place in the form of maize farming, the remainder is reasonably vegetated with grasses and soil erosion does not appear to be substantial as no erosion gullies or dongas were seen on the site.

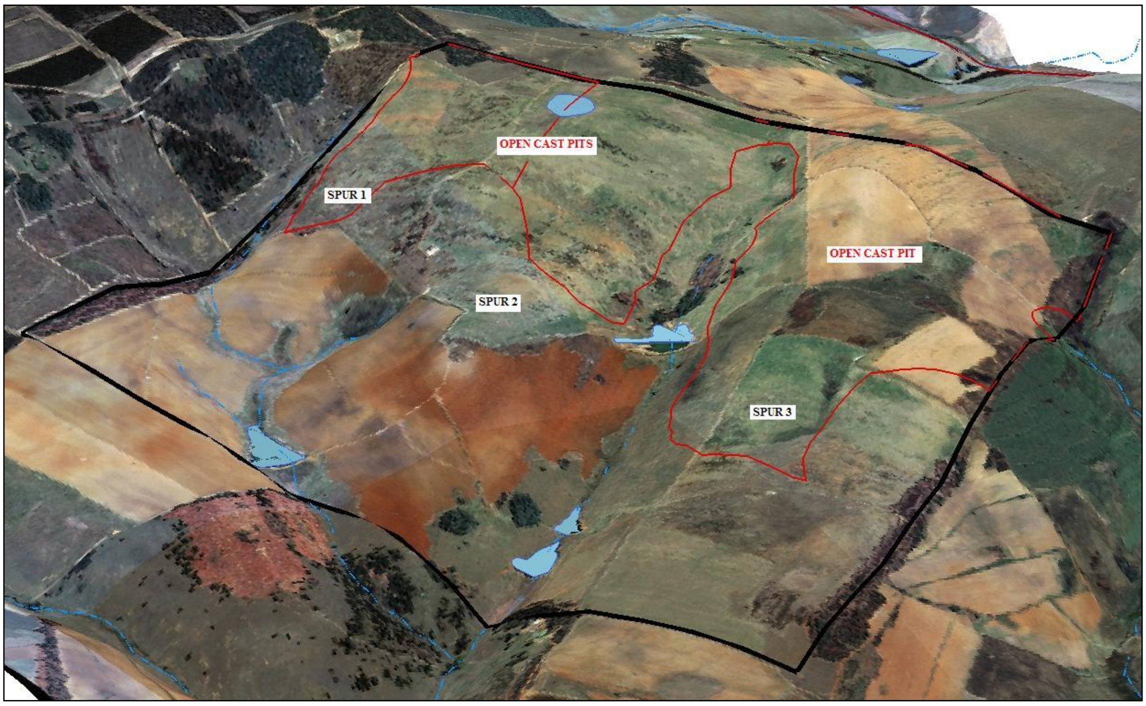


Figure 6: 3D Model of site in a north-easterly direction

2.1.1.3 Geology

Regional geology

As can be seen on the Geology Map (Plan5), the site is located on the Vryheid formation (Pv) which is part of the Ecca group, which in turn is part of the Karoo Supergroup. The Karoo Supergroup covers a large tract of South Africa as it formed by the process of sedimentation within a deltaic, fluvial environment in the extensive Karoo Basin during the late Carboniferous to Middle Jurassic periods. The Vryheid formation typically comprises of fine to coarse-grained sandstones, shales and coal seams. It is the No. 2 coal seam which is to be mined in this case. The strata of this formation are generally upward coarsening in grain; this is reflective of rhythmic/seasonal variations in fluvial input within the deltaic environment (Johnson et al, 2006). The coal seams generally developed as peat swamps on broad alluvial plains which were then covered and compacted in an oxygen free environment to form coal.

As per the map, there is Vaalian Diabase (V-di) present at the south-western corner of the site; an outcrop of this diabase was found in the valley bottom nearing this area, confirming its presence. There are no other faults, dykes or lineaments indicated on the site which are common in the Karoo Supergroup.

Coal seams

The Weltevreden Project falls in the Witbank coalfield. The generalised succession consists of interbedded sandstones and mudstones with associated coal seams, and is typical of the Witbank coalfield. The unconsolidated overburden varies from 4 – 6 meters in thickness, although areas over 10 meters are not uncommon. The results of the boreholes drilled show that the coal seams appear to be generally undisturbed. The coal seams have been affected to a varying degree by the chemical weathering process, which in certain cases may remove the economic mining horizons. The Weltevreden Project area is underlain by No. 2 seam is between the subcrop in the west and the eastern boundary.

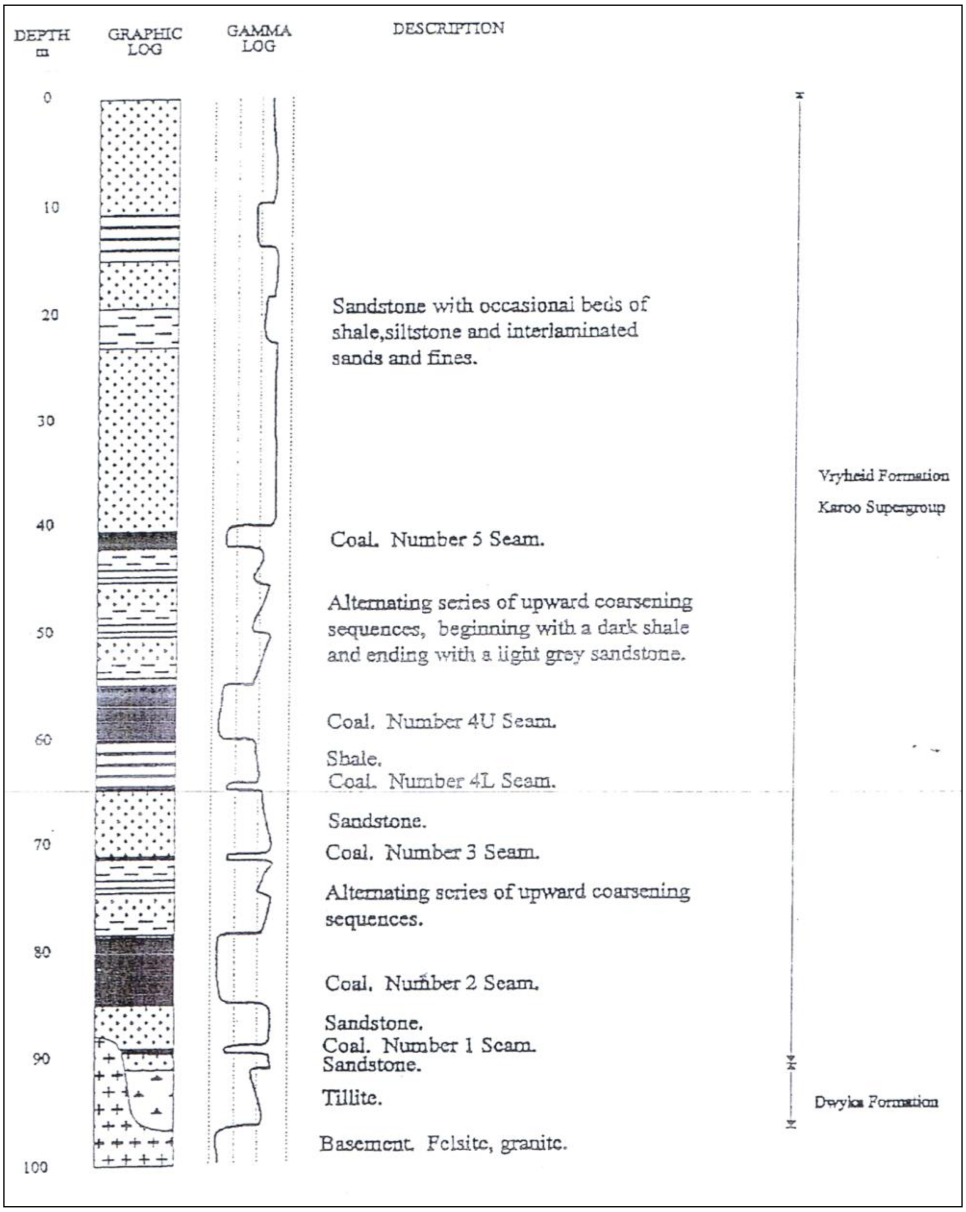


Figure 7: Typical borehole log for the Witbank coal field (Anhaeusser & Wilson, 1998)

<u>Depth of the mineral below surface</u>

The No 2 seam is ranges from 0m at outcrop to approximately 30m below the surface and has a thickness of between 1.2m and 4.15m. The seam thickness decreases to the south of the site where it splits into two seams of 0.3cm each separated by a mudstone and eventually outcrops as a carbonaceous mudstone. The seam dips generally in a south-westerly to southerly direction.

Plan 4: Geology

2.1.1.4 Soils

DWA appointed Rehab Green Monitoring Consultants cc to conduct a soil, land capability and land use assessment of the proposed coal mining operations on portions 15 and 16 of the farm Weltevreden 381 JT in the Mpumalanga Province. This section details the baseline soil conditions, land capability and land use of the study area. The soil, land capability and land use assessment report is attached as Appendix E.

Soil types

Soils were surveyed by hand auger observations at a fixed point grid with a density of 150 x 150 meters. Additional observations were made in between grid points where necessary to accurately locate the boundaries of various soil types. The observed soils were classified into soil forms according to the Taxonomic System for South Africa (SCWG, 1991).

As illustrated in Plan 6 a total of 13 soil types were identified based on dominant soil form and effective soil depth, including Hu1, Hu2, Hu3, Cv1, Av1, Gc1, Gc2, Dr1, Lo1, Ka, Dr2, Ms/R and Hu/R. The soil map also summarises each of these soil types in terms of the dominant and subdominant soil forms and families, average effective soil depth, clay content of the A and B- or E- or G-horizon, texture class, agricultural potential, land capability and extent (71% of the farm portions consists of soils with moderate to high agricultural potential).

Derived soil properties

The fertility, erodibility, dry land production potential and irrigation potential of each soil type were derived and classified into three, as summarised in Table 4 The results are shown in Table 5.

Plan 5: Soil Types

Table 4: Soil property classes

Soil property	Classes		
	Low	**Medium**	**High**
Natural fertility	Concentration of essential macro elements is less than threshold extraction levels of annual crops; and Fertilisation should substantially exceed annual crop extraction levels to ensure a build-up of the natural fertility.	Concentration of essential elements is more or less the same than threshold extraction levels of annual crops; and Fertilisation should exceed annual crop extraction levels to ensure a slow build-up of the natural soil fertility.	Concentration of essential elements is more than the threshold extraction levels by annual crops; and Fertilisation should meet annual crop extraction levels to maintain the natural fertility.
Erodibility	Stable physical and chemical properties; Occur on flat to gentle slopes; and Few erosion protection measures are necessary.	Low to moderately unstable physical or chemical properties Occur on moderate to steep slopes; Sheet and rill erosion often occur in the natural state, but becomes severe when disturbed or misused; and Erosion protection measures are necessary.	Unstable physical and chemical properties; Occurs on very steep slopes; Rill and donga erosion often occur in the natural state and becomes severe during any disturbance or misuse; and Specialised erosion protection measures are necessary.
Dry land crop production potential	Production seriously limited by negative soil properties*.	Production limited by some negative soil properties*.	Production limited by very little negative soil properties*.
Soil potential for irrigation	Irrigation potential seriously limited by negative soil properties*.	Irrigation potential limited by some negative soil properties*.	Irrigation potential limited by very little negative soil properties*.
Notes” * Insufficient soil depth, very sandy textures, very high clay textures, strong structured horizons, wet and water logged horizons, steep slopes and low fertility.			

Table 5: Derived soil properties

Code	Natural Fertility	Erodibility	Dry land crop production potential	Soil potential for Irrigation
Hu1	Moderate-low	Low	High	High
Hu2	Moderate-low	Low	High	High
Hu3	Moderate-low	Low	Moderate	Moderate-low
Cv1	Moderate-low	Low	Moderate	Moderate
Av1	Moderate-low	Low	Moderate	Moderate
Gc1	Moderate-low	Low	Moderate	Moderate
Gc2	Moderate-low	Low	Low	Low
Dr1	Moderate-low	Low	Low	Low
Lo1	Low	Moderate	Low	Low
Ka	Moderate-low	Low	Low	Low
Dr2	Low	Low	Low	Low
Ms/R	Low	Low	Low	Low
Hu/R	Moderate	Low	Low	Low

Soil chemical properties

A sample of the A- and B- or E- or G-horizon of the dominant soil types were taken at 12 localities. The localities of the sampling points are shown in Plan 6 and the soil chemical results are shown in Table 6.

The cation concentrations (K, Ca and Mg) of the dominant soil types are generally moderate to low. Phosphorus concentrations are low, except for sampling points G13 and H9 which is high. The pH values vary between 4.54 and 5.76, which indicate fairly acidic soil conditions.

Table 6: Soil chemical properties

Sample No.	Soil Form	Horison	Depth	K	Ca	Mg	N	T. Acid	Acid sat.	Resistance	P	pH
				mg/kg				cmol(+)/kg	%	ohm	mg/kg	(H_2O)
G13	Cv2100	A1	0-250	20	160	56	0.1	0.4	23.3855	3470	18.7	5.16
		B1	350-700	68	455	89	0.1	0	-	1630	1.3	5.6
H9	Dr2000	A1	0-250	90	382	111	1.2	0	-	3310	36.3	5.63
J6	Hu2100	A1	0-250	220	174	118	3.9	0.2	7.6861	2450	2.7	5.37
		B	350-700	88	57	110	3.2	0.34	19.3749	4910	1.3	5.21
J11	Cv2100	A1	0-250	127	787	66	1.7	0.24	4.7665	4500	9.1	5.29
		B1	350-700	56	167	42	2.9	0.33	19.9729	5850	2.2	5.23
J13	Hu2100	A1	0-250	39	144	52	1.5	0.73	36.9379	5210	2.9	4.84
		B	350-700	12	240	61	5.8	0.44	20.2732	5360	0.25	5.12
L9	Hu2100	A1	0-250	73	257	62	0.9	0.36	-	3770	4.5	5.19
		B1	350-700	33	332	70	2.4	0.49	17.4550	3700	0.1	5.06
N12	Lo/Kd1000	A1	0-250	64	54	34	9.5	0.89	55.5216	5050	0.37	4.67
		E1	350-700	82	223	190	12.6	0	-	3830	0.29	5.56
		B1	700-1000	58	172	142	10.4	0	-	4300	0.33	5.68
N15	Cv2100	A1	0-250	51	236	56	0.9	0.36	16.9095	3120	13.5	5.2
		B1	350-700	25	240	52	1	0.4	19.1431	3880	1.2	5.16
P9	Cv2100	A1	0-250	88	504	99	0.6	0	-	2610	2.8	5.73
		B1	350-700	23	242	67	1.5	0.1	5.2142	4320	0.41	5.46
P11	Gf2100	A1	0-250	123	574	83	0.6	0	-	1990	13.6	5.76

Sample No.	Soil Form	Horison	Depth	K	Ca	Mg	N	T. Acid	Acid sat.	Resistance	P	pH
				mg/kg				cmol(+)/kg	%	ohm	mg/kg	(H_2O)
		B1	350-700	52	742	86	1.4	0	-	3360	5.4	5.72
4	Cv2100	A1	0-250	26	49	16	1.4	1.02	69.7343	4880	2.1	4.54
		B1	350-700	12	32	15	2.6	0.74	70.2202	8310	1.9	4.81
9	Dr2000	A1	0-250	33	111	34	4.6	0.44	32.3976	4200	2.6	5.08

2.1.1.5 Pre-mining land capability

Each soil type can be grouped into land capability classes, as defined by the Guidelines for the Rehabilitation of Mined Land (CMSA & CRA, 2007). Soil properties such as effective soil depth, mechanical limitation, internal drainage, soil texture, soil structure, erosion susceptibility and slope percentage were evaluated in order to classify the dominant soil types into four land capability classes, namely arable land, grazing land, wetlands/riparian areas and wilderness land.

The various land capability classes, as well as their extent and proportion of the total study area, are illustrated in Plan 6.

Wetlands

Soil types Dr1, Lo1, and Ka were classified as wetlands according to A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas (DWAF, 2003). Terrain unit, soil form, soil wetness and vegetation indicators were used to locate the outer edge of temporary and seasonal wetland zones.

The wetland units illustrated in Plan 7 represent the outer edge of the wetland, which is already largely disturbed by agricultural activities. It functions as a surface drainage system, an important habitat and a mechanism to recharge the ground water system as well as open water sources downstream.

Four of the seasonal and permanent wetland zones (soil types Ka and Lo1) which forms part of drainage lines and are linked to open water sources needs to be protected and should preferably be excluded from the proposed opencast area (this area is shown in the soil utilisation guide, Plan 20) . These wetland zones should also be protected by means of a 50m buffer zone. Degraded seepage zones of soil types Lo1 and Dr1 can be included in the proposed opencast area.

Plan 6: Pre-mining land capability

2.1.1.6 Land use

The extent of land use practices were surveyed during the time of the soil assessment. The current land use of the farm Weltevreden 381 JT is maize and grazing. The current land uses, the number of units per land use, the area and percentage comprised by each land use is illustrated in Plan 8. The current land use, the number of units per land use, the area and percentage comprised by each land use is shown in Table 7.

Table 7: Areas and percentages of current land uses

LEGEND – CURRENT LAND USE				
Land Use Code	**Current Land Use**	**Unit Count**	**Area (ha)**	**Area (%)**
M	Dry land maize production.	5	262.93	51.99
G	Grazing – Areas properly fenced off and permanently used for grazing purposes. Mainly commercial cattle farming.	2	171.20	33.85
DW	Dense wattle infestation – no specific land use.	1	7.94	1.57
D	Local farm dams.	4	6.32	1.24
V/G	Mainly small patches within maize fields which are wet or shallow but not fenced off and there not grazed. Probably grazed during winter together with maize rests.	16	57.32	11.34
	TOTAL	**28**	**505.71**	**100.0**

<u>Historical agricultural production</u>

The maize fields indicated in Plan 8 has been cultivated for many years, as derived from the 1:50 000 topographical map of the study area. Crop yields vary from farm to farm and even between different fields on the same farm, due to varying characteristics of soil types. This includes variations in effective soil depth, texture, water holding capacity, annual precipitation and farm management. Crop yields are therefore strongly correlated with soil properties.

Long term average crop yields have been estimated according to the various soil types and associated properties, assuming an average precipitation between 650 and 750 mm per annum. The results are summarised in Table 8.

Table 8: Historical agricultural production

Product	Soil Types	Derived soil potential	Potential Yield (tons/ha/annum)
Maize (Dry land)	Hu1, Hu2	High	4 – 6
	Hu3, Cv1, Av1, Gc1	Moderate	3 – 4
Soybeans (Dry land)	Hu1, Hu2	High	1.8 – 2.2
	Hu3, Cv1, Av1, Gc1	Moderate	1.5 – 2

Evidence of misuse

No evidence of misuse was observed.

Existing structures

Existing structures are farm fences, a power line and 4 farm dams.

Plan 7: Land use

2.1.1.7 *Surface water*

Surface water quantity

Catchment boundaries

The site is located in Inkomati Water Management Area (WMA 05) inside the boundaries of quaternary catchment X11D which falls in the primary catchment X. There is a defined major ridge that can be seen on Plan 9 which forms part of the primary catchment area boundary (watershed) of the greater Komati River. The proposed site is approximately 2.5km from this watershed and occurs near the fringe of the catchment area at a high elevation of 1886m.a.m.s.l. which is also at the source of the streams that run through the area (Plan 8). This elevation position is important for surface water issues with specific regard to pollution as any polluted surface water on the site has the potential to pollute a very important major river system downstream (Komati). On the site itself, the altitude varies between 1880 m.a.m.s.l. at the highest point and 1795m.a.m.s.l. at the lowest point. The existing range (difference in height) between these two extreme elevations is 85m. This information can be further translated into a percentage of average catchment gradients on the site of 4% which is relatively steep. Since the sub catchments comprise of very small surface areas, this gradient will in turn also contribute to large quantities of water flow along the streams.

The farm Weltevreden is located on a watershed area draining in a southerly direction away from the town of Belfast. The intermittent stream that falls in the project area, as well as the intermittent streams in the surrounding area, drains into a main tributary of the Komati River which later drains into the Nooitgedacht Dam.

Catchment characterization

The catchment area is characterised as a rural setting including a few small farm dams with no urban surroundings contained within the entire catchment area. The land cover characteristics of the catchment consist of cultivated fields or grasslands with the contained veld in a fairly good condition causative to a moderate storm flow potential.

Catchment delineation

All surface water on the proposed site drains into a farm dam located south-east of the site. Thus the water quantity and quality of this resource could be affected by the proposed mining activity. Sub-catchments were delineated according to the effect that the mine could have on streams feeding this water resource. The total catchment area that feeds this specific dam is 18km^2. Two sub-catchments feeding into the dam and a third sub-catchment situated to the south-west of the proposed mining site were delineated. The third sub-catchment (not within the site boundaries) was delineated as the affected catchment around it falls within the site boundary. Thus mining on the proposed site could have an impact on sub-catchment three and the stream that it feeds. Table 9 represents a summary of the sub-catchments and their associated relative areas.

Table 9: Sub-catchments and their relative areas.

Catchment	Area (ha)	Area (km^2)
1 (Total)	1790	17.90
2 (sub1)	337	3.37
3 (sub2)	333	3.33
4 (sub3)	531	5.31

Mean annual runoff (MAR)

The Mean Annual Runoff (MAR) of the quaternary catchment X11D is 88mm, which is representative of a net MAR of 51.8 Mm^3 (million cubic meters). The Mean Annual Precipitation (MAP) of the catchment is 744mm. These values represent a MAR:MAP ratio of 11.8% for the X11D quaternary catchment area. The Mean Annual Evaporation (MAE) is 1450mm for the specific quaternary catchment.

Normal dry weather flow

During normal dry weather seasons, the volume of flow of the X11D quaternary catchment area is normally 31.41Mm^3/a.

Plan 8: Sub - catchment boundaries

Flood volumes

The peak flows for the various sub-catchments delineated were assessed utilising a combination of the following Rainfall-Runoff methods:

- Rational;
- Alternative Rational;
- Standard Design Flood (SDF); and
- Soil Conservation Services (SCS).

Rational Method

The rational method was developed in the mid 19th century and is one of the best known and most widely used methods for the calculation of peak flows for small catchments. The formula indicates that Q = CiA, where the product of the rainfall intensity (i) and Runoff area (A) is equal to the inflow rate for the system (iA) and C is the runoff coefficient.

Alternative Rational Method

The alternative rational method is based on the rational method with the point precipitation being adjusted to take into account local South African conditions.

Standard Design Flood

The standard design flood method (SDF) was developed by Alexander (2002) specifically to address the uncertainty in flood prediction under South African conditions. The runoff coefficient (C) is replaced by a calibrated value based on the sub division of the country into 26 regions or Water Management Areas (WMAs). The method is generally a more conservative estimate than the other methods e.g. rational method or unit hydrograph methods.

Soil Conservation Services Method

The United States Department of Agriculture's soil based technique (SCS) for the estimation of design flood volume and peak discharge from small catchments (i.e.<30km^2) were originally adapted for use in Southern Africa by Schulze and Arnold in 1979. Based on extensive research and extended databases an updated version of this method was developed further for Southern Africa by Schmidt, Schulze and Dent (1987). The flows of flood peaks (m^3/s) calculated for the delineated sub-catchments are summarised in Table 10 for the 1:100 year.

Table 10: Flood Peaks - 1:100 year return period

Sub-Catchment	Rational (m^3/s)	Alternative Rational (m^3/s)	SDF (m^3/s)	SCS (m^3/s)
2 (sub1)	89.03	85.75	70.02	31.5
3 (sub2)	74.17	70.26	59.21	26.5
4 (sub3)	102.96	97.06	80.1	45.2

The results from Table 10 indicate that the solutions using all four methods i.e. Rational, Alternative Rational, Standard Design Flood and SCS methods are relatively close to one another for all the sub-catchments except for the SCS method. The reason for this is that the SCS method has an added advantage over the other three methods because it also takes into consideration soil and moisture conditions of a catchment prior to a design flood. It was however decided that the most conservative values should be considered and hence the 1:100 year flood results from the Rational method were used for the determination of the water surface profiles and the flood lines.

The flood lines, the 100m buffer zone around the streams, as well as the exclusion zone for mining or mine infrastructure placement were delineated. It was concluded that the two sub-catchments that drain into the water resource of concern contribute 40% of the total surface water drainage to the dam. Mining the proposed area could ultimately have a negative impact on both water quantity and quality of the dam. Less water could drain into the dam when mining commences due to abstraction. Should chemical spillages occur and not properly contained at the source, polluted water could drain into the dam.

The exclusion zone (100m buffer zone), 1:100 year flood lines were delineated (Plan 10).

Plan 9: Floodline delineation

Surface water quality

Two hydrocensus visits were undertaken in which surface water samples were collected from the water resources in the vicinity (Plan 11). A total of 17 surface water points (including the rivers, streams and pans) were sampled in the area in two hydrocensus visits to the site and these were analysed for physical and chemical water quality parameters.

The data from the sample analysis was plotted on a piper diagram to assess the quality (Figure 8) and benchmarked against the SANS 241 (2005) as summarized in Table 11 and Table 12. Two DWAF water quality monitoring sites downstream of the mining area but within the X11D quaternary catchment although outside the Municipal Boundary (Plan 8) have been included to also use as reference data of how the water quality downstream of the project area is characterised.

The piper diagram (Figure 8), indicates that most of the samples were clustered around the chloride-nitrate quadrant and the sodium and potassium quadrant. Only two samples, Adit and WNSW 09 (sampled at the same source) were found to fall within the sulphate dominated quadrant. This is indicative of impacts related to previous mining in the proposed project area, while the rest of the samples are less impacted by mining and more by agricultural activities. Thus the general water chemistry indicates that there is less mining associated impact on the samples collected, thus the proposed project should aim to prevent any deterioration of the water quality in the area.

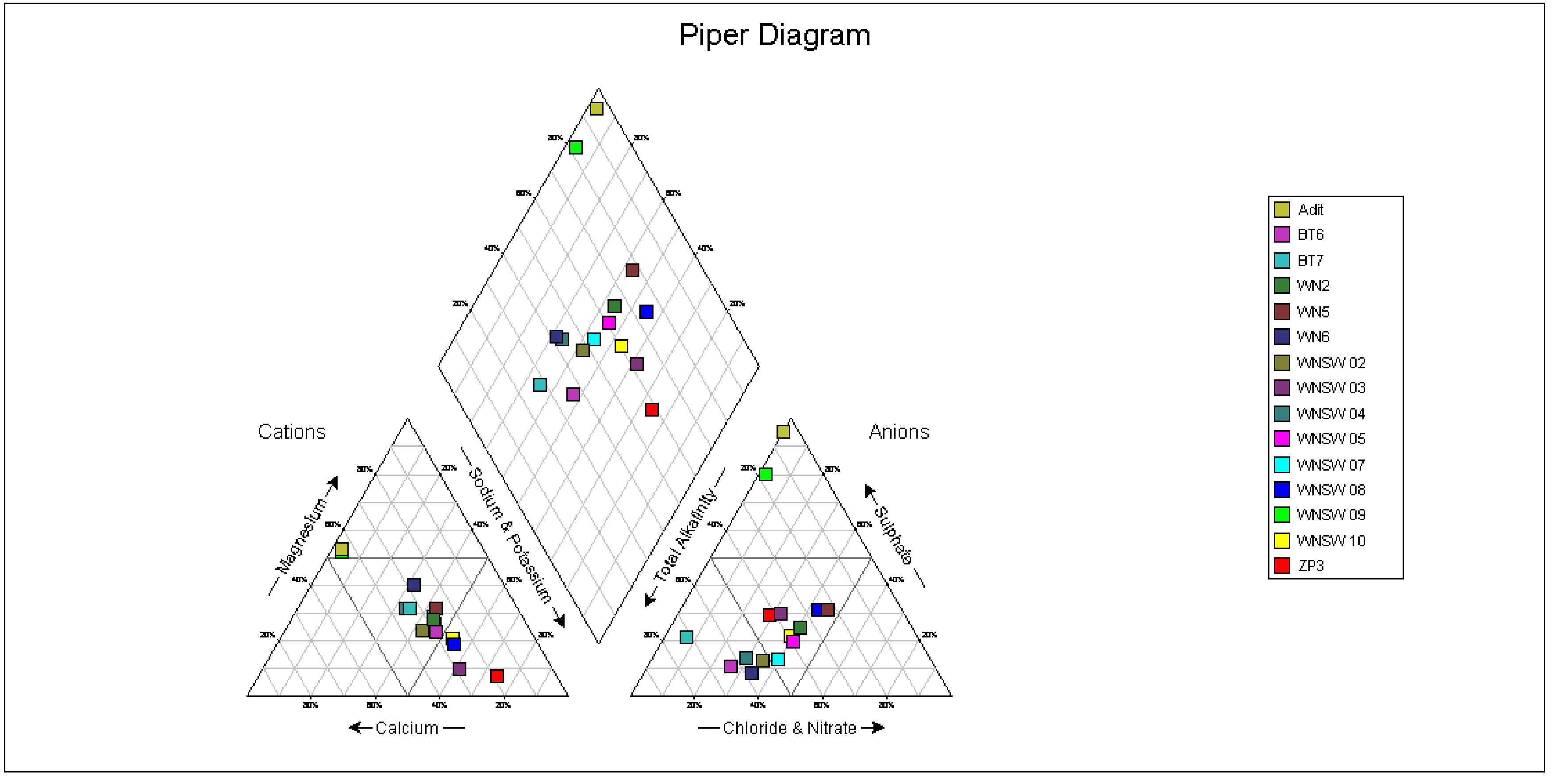


Figure 8: Piper diagram of the analyzed water quality samples.

The results of the surface water quality samples collected are presented in Table 11 and Table 12 for samples collected during the 1st and 2nd hydrocensus respectively. These Tables indicate SANS 241 (2005) levels, DWAF water quality monitoring sites data and the laboratory results of the analysed samples. The following was deduced from the results obtained during the first hydrocensus (Table 11):

- The sample collected at the Pan 1 exceeded SANS 241 (Class III) for TDS, SO_4, Ca, Mg, Mn, EC, pH, Al and COD. These high levels are associated with the fact that the pan is fed by runoff from the mined area on the farm Vogelstruispoort, the quality is as a result of the un-rehabilitated mine workings;
- The Adit sample also had high sulphate levels associated with mining related impacts from the un-rehabilitated spoils left by previous mining that occurred in the area;
- Sample BT7 had high levels of Fe, Al and COD while this site is downstream of the proposed project area, the exceedances could only be attributed to previous mining activities that took place in the area; and
- There was a generally high COD level in all the samples with the exception of ZP3 which is upstream of the proposed project. This could be due to the fact that the samples were collected in October prior to the commencement of the wet season.

Table 11: Surface water quality data (Sampled October 2008) benchmarked against the SANS 241 Drinking water standards indicating the closest DWAF water quality monitoring stations (outside the sub-catchment and municipal boundary).

Element	SANS 241(2005)			DWAF Data		BT7	BT6	ZP3	Adit	WN 6	WN 5	WN 2	Pan 1
	Class I (Acceptable)	Class II (Max. Allowable)	Class III (Exceeding)	X1H033Q01	X1R001QO1								
TDS	<1000	1000-2400	>2400			62	50.0	24.0	1850	106	84.0	116	4262
Suspended Solids						28	77.6	1.60	7.36	4.80	1.60	8.80	36.4
Nitrate N03 as N (Health)	<10.0	10-20	>20	0.09	0.09	0.88	0.91	2.00	0.32	0.33	0.33	0.46	0.37
Chloride as Cl	<200	200-600	>600	9.01	7.54	3	8.00	4.00	5.00	23.0	22.0	27.0	40.0
Total Alkalinity as CaCO3						40	27.0	8.00	57.0	55.0	15.0	32.0	
Fluoride as F	<1	1-1.5	>1.5	0.23	0.18	0.1	0.20	0.10	0.27	0.10	0.10	0.10	0.10
Sulphate as SO4	<400	400-600	>600		17.4	11.2	4.30	5.40	1250	7.40	20.4	21.7	2900
Total Hardness as CaCO3				95.6		29.5	19.1	4.07	1236	58.2	34.7	46.5	2285
Calcium Hardness as CaCO3						15.1	10.6	2.92	557	24.0	15.5	23.6	952
Magnesium Hardness as CaCO3						14.4	8.44	1.15	679	34.2	19.2	22.9	1333
Calcium as Ca	<150	150-300	>300	12.8	11.2	6.06	4.26	1.17	223	9.60	6.20	9.44	381

Magnesium as Mg	<70	70-100	>100	11	8.08	3.49	2.05	0.28	165	8.32	4.66	5.56	324
Sodium as Na	<200	200-400	>400	8.17	7.38	7.17	7.38	5.01	10.2	11	8.05	11.8	178
Potassium as K	<50	50-100	>100	2.36	2.65	0.37	0.83	0.78	14.9	2.58	6.99	8.76	47.8
Iron as Fe	<0.2	0.2-2	>2			1.86	0.26	0.005	0.005	0.005	0.005	0.02	0.41
Manganese as Mn	<0.1	0.1-1	>1			0.005	0.005	0.005	0.08	0.005	0.005	0.005	10.3
Conductivity mS/m	<150	150-370	>370	20.3	18.2	8.08	6.80	3.16	201	17.3	13.8	17.8	410
pH-Value at 25 ° C	5-6 or 9.0-9.5	4-5 or 9.5-10	<4 or >10	7.73	7.7	6.69	6.92	6.16	7.60	7.20	6.84	7.34	3.74
pHs at 21°C						8.67	9.02	10.1	7.11	8.36	9.12	8.60	9.22
Langelier Saturation Index						-1.98	-2.1	-3.91	0.49	-1.16	-2.28	-1.26	-5.48
Ortho-Phosphate P04 as P				0.02	0.02	0.26	0.21	0.16	0.16	0.16	0.17	0.21	0.16
Total Chromium Cr	<0.1	0.1-0.5	>0.5			0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Bicarbonate HCO3 as CaC03						40	27.0	8.00	57.0	0.55	15.0	32.0	
Aluminum as Al	<0.3	0.3-0.5	>0.5			1.63	0.08	0.005	0.005	0.005	0.005	0.01	6.61
Chemical Oxygen Demand	<10	10-20	>20			19.8	31.7	2.00	11.9	31.7	43.7	47.6	23.8
Copper as Cu	<1	1-2	>2			0.005	0.005	0.00	0.005	0.005	0.005	0.005	0.01
Cobalt as Co	<0.5	0.5-1	>1			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18

						5	5	5	5	5	5	5	
Free & Saline Ammonia as NH3				0.002	0.002	0.79	0.70	0.50	0.37	0.47	0.44	0.67	1.20
Units in mg/L except for pH (pH units) and EC (mS/m)													

From the second hydrocensus (Table 12), the following deductions were made:

- The WNSW 09 sample showed high levels of TDS, Ca and EC with the sulphate levels exceeding the SANS 241 Class III standard. The sample was collected during the wet season at the similar Adit site and is characteristic of pollution related to previous mining activity in the area;
- WNSW 03 had high levels while WNSW 05 exceeded Class III levels of Fe and Al respectively. Similarly, this is attributed to previous mining activity also taking note that WNSW 05 was collected at the beginning of a non perennial stream that feeds the dam; and
- In general, the chemical water quality in the area is good except for stagnant water found in surface water bodies such as pans for which the water quality was found to exceed the standards for a number of constituents; this is related to previous mining in the area and the fact that the pan is fed by run-off associated with un-rehabilitated spoils.

The water quality data of two DWAF monitoring points namely X1R001Q01 and X1R033Q01 (which are downstream of the proposed project area (close to the Nooitgedacht Dam) was assessed and used to formulate trends as a reference for the downstream water quality pre-mining of the proposed project. Unfortunately there are no upstream DWAF water quality monitoring sites and therefore no data is available to understand the water balance into- and out of the study area. The trend analysis indicated the following:

- There is an increase in sulphate and EC over time;
- The increase in EC and sulphate is still below the SANS 241 (Class 1) target; and
- pH trend is constant within the SANS 241 (Class 1) target.

Table 12: Surface water quality data (Sampled February 2009) benchmarked against the SANS 241 Drinking water standards indicating the closest DWAF water quality monitoring stations (outside the sub-catchment and municipal boundary).

	SANS 241(2005)			DWAF Data										
	Class I	Class II	Class III											
Element	(Acceptable)	(Max. Allowable)	(Exceeding)	X1H033Q01	X1R001QO1	WNSW 01	WNSW 02	WNSW 03	WNSW 04	WNSW 05	WNSW 07	WNSW 08	WNSW 09	WNSW 10
TDS	<1000	1000-2400	>2400			40	54	76	60	60	62	50	1300	66
Suspended Solids						0.2	4.4	411	0.8	187	0.2	0.2	0.2	0.2
Nitrate N03 as N (Health)	<10.0	10-20	>20	0.09	0.09	0.05	0.05	0.05	0.005	0.5	0.5	0.5	0.5	0.5
Chloride as Cl	<200	200-600	>600	9.01	7.54	10	11	14	11	15	15	12	15	15
Total Alkalinity as CaCO3						2.5	23	23	30	20	25	10	162	21
Fluoride as F	<1	1-1.5	>1.5	0.23	0.18	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.22	0.1
Sulphate as SO4	<400	400-600	>600		17.4	14.2	5.4	17.7	7	9.6	6.8	11.7	692	11
Total Hardness as CaCO3				95.6		10	24	18	33	25	28	16	951	22
Calcium Hardness as CaCO3						5	14	13	17	13	14	9	437	12
Magnesium Hardness as CaCO3						5	10	5	1	12	14	7	514	10
Calcium as Ca	<150	150-300	>300	12.8	11.2	2.1	5.68	5.35	6.88	5.17	5.49	3.73	157	4.8
Magnesium as Mg	<70	70-100	>100	11	8.08	1.18	2.44	1.1	3.8	2.9	3.41	1.63	125	2.93
Sodium as Na	<200	200-400	>400	8.17	7.38	7.45	6.67	10.9	7.39	9.25	8.6	7.67	8.94	9.39
Potassium as K	<50	50-100	>100	2.36	2.65	1.78	2.78	3.74	0.63	0.44	2.2	2.34	12.2	3.96
Iron as Fe	<0.2	0.2-2	>2			0.005	0.005	39.3	0.005	1.34	0.3	0.26	0.005	1.58
Manganese as Mn	<0.1	0.1-1	>1			0.02	0.005	0.29	0.005	0.005	0.005	0.005	0.005	0.005
Conductivity mS/m	<150	150-370	>370	20.3	18.2	6.7	8.9	10.1	9.9	9.8	10.5	7.78	153.8	10
pH-Value at 25 ° C	5-6 or 9.0-9.5	4-5 or 9.5-10	<4 or >10	7.73	7.7	5.67	6.65	5.85	7.55	6.24	6.99	6.41	7.52	6.67
pHs at 21°C						10.75	8.94	9.01	8.74	8.94	8.90	9.32	9.32	9.06
Langelier Saturation Index						-5.08	-2.29	-3.16	0.39	-2.7	-1.91	-2.91	0.73	-2.39
Ortho-Phosphate P04 as P				0.02	0.02	0.12	0.1	0.1	0.12	0.11	0.12	0.28	0.12	0.12
Total Chromium Cr	<0.1	0.1-0.5	>0.5			0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.05	0.005
Bicarbonate HCO3 as CaC03						2.5	23	23	30	25	25	15	142	21
Aluminum as Al	<0.3	0.3-0.5	>0.5			0.03	0.01	0.52	0.005	0.15	0	0.01	0.005	0.04
Chemical Oxygen Demand	<10	10-20	>20											
Copper as Cu	<1	1-2	>2			0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Cobalt as Co	<0.5	0.5-1	>1											
Free & Saline Ammonia as NH3				0.002	0.002	0.20	0.68	2	0.88	0.99	0.84	0.76	0.69	0.69
Units in mg/L except for pH (pH units) and EC (mS/m)														

In a subsequent hydrocensus (08 June 2009), four surface water samples were collected and sent for analyses at Regen Waters a SANAS accredited water quality analysis laboratory. The data was benchmarked against the SANS 241 (2005) drinking water specification. The results (Table 13) indicated that samples VPSW1 and VPSW2 exceeded the SANS Class 3 level in terms of Sulphate concentration. This is indicative of mining related impacts and was attributed to the presence of old and un-rehabilitated spoils from previous mining that took place in the area. The high Sulphate level could indicate the presence of AMD which is negatively impacting on the surface water resources. The presence of AMD and associated salt also manifests itself as an increase in TDS which was recorded for samples VPSW1 and VPSW2. These high salts and TDS result in the increase in Electrical Conductivity (EC). Calcium levels of Class 2 were also recorded for VPSW1 and VPSW2 samples.

Sample ZKSW1only exceeded the SANS 241 (2005) for Iron (Fe) concentration. This high level of Fe could not be ascribed to AMD since it did not have high levels of SO4 or TDS and the EC was within the ideal (Class 1) target.

The water quality data was also plotted on a piper diagram (Figure 9) and the samples VPSW1 and VPSW2 were clustered in the Sulphate dominant water quality which is indicative of mining related impacts.

Table 13. Water quality data (sampled June 2009) benchmarked against SANS 241 (2005) for drinking water specifications.

Element	SANS 241(2005)			ZKSW2	ZKSW1	VPSW1	VPSW2
	Class I (Acceptable)	Class II (Max. Allowable)	Class III (Exceeding)				
TDS	<1000	1000-2400	>2400	40	44	1480	1484
Suspended Solids							
Nitrate N03 as N (Health)	<10.0	10-20	>20	<0.1	<0.1	0.20	<0.1
Chloride as Cl	<200	200-600	>600	9.0	10.0	4.0	4.0
Total Alkalinity as CaCO3				9.0	10.0	36.0	59.0
Fluoride as F	<1	1-1.5	>1.5	<0.20	<0.20	<0.20	0.22
Sulphate as SO4	<400	400-600	>600	8.40	9.60	950	920
Total Hardness as CaCO3							
Calcium Hardness as CaCO3							
Magnesium Hardness as CaCO3							
Calcium as Ca	<150	150-300	>300	2.42	2.62	207	198
Magnesium as Mg	<70	70-100	>100	1.26	1.51	126	143
Sodium as Na	<200	200-400	>400	7.50	7.26	7.30	7.79
Potassium as K	<50	50-100	>100	1.55	2.02	10.5	12.0
Iron as Fe	<0.2	0.2-2	>2	0.11	14.2	<0.01	<0.01
Manganese as Mn	<0.1	0.1-1	>1	<0.01	<0.01	0.38	0.15

Conductivity mS/m	<150	150-370	>370	7.54	7.81	172	173
pH-Value at 25 ° C	5-6 or 9.0-9.5	4-5 or 9.5-10	<4 or >10	6.88	6.92	6.95	7.32
pHs at 21°C							
Langelier Saturation Index							
Ortho-Phosphate P04 as P							
Total Chromium Cr	<0.1	0.1-0.5	>0.5				
Bicarbonate HCO3 as CaC03							
Aluminum as Al	<0.3	0.3-0.5	>0.5	<0.01	<0.01	<0.01	0.02
Chemical Oxygen Demand	<10	10-20	>20				
Copper as Cu	<1	1-2	>2				
Cobalt as Co	<0.5	0.5-1	>1				
Free & Saline Ammonia as NH3				<0.2	<0.2	<0.20	<0.20
Units in mg/L except for pH (pH units) and EC (mS/m)							

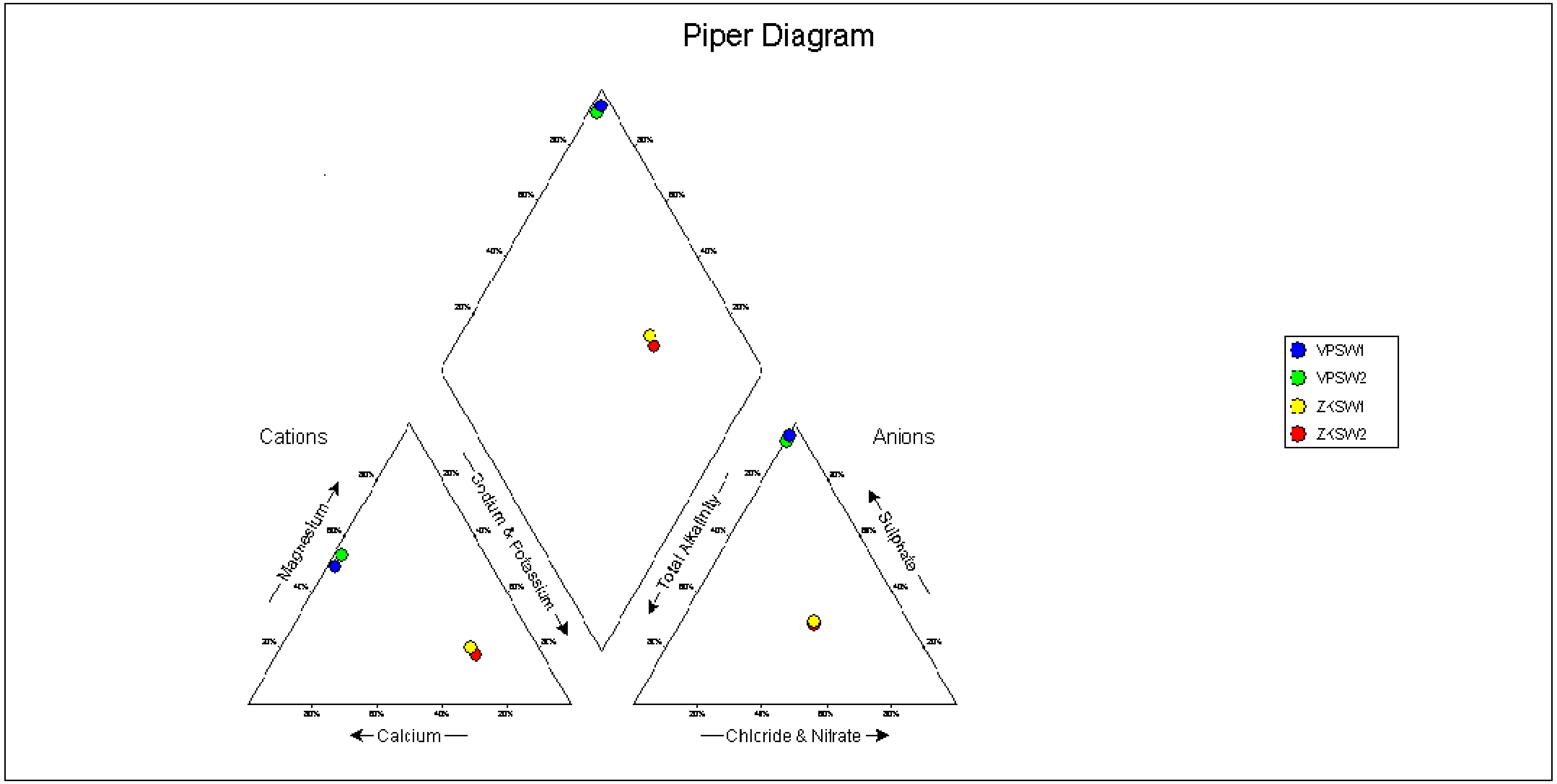


Figure 9: Piper diagram indicating water quality sampled June 2009.

Plan 10: Hydrocensus points

Surface water use

Total number of registered water users in X11D catchment (WARMS, 2008) is 51 (Table 14), with the majority of the water users registered for irrigation (40) followed by livestock watering (10) and a schedule 1 user (1).

Table 14: Summary of water uses (adapted from WARMS, 2008).

Number of registered water users				
Description	**Irrigation**	**Livestock watering**	**Schedule 1**	**Total**
Number of users	40	10	1	51
Number of users per specific abstraction point				
Boreholes	3	7		10
Dams	8	1		9
Rivers/streams	27	2		29
Spring/Eye	1			1
Wetlands	1	1		2
Number of users per volume abstracted				
Volume (m^3/a)	**Irrigation**	**Livestock watering**	**Schedule 1**	**Total**
0 - 10 000	1	9	1	11
> 10 000 - 100 000 m^3	18	1		19
> 100 000 - 200 000 m^3	9			9
> 200 000 - 500 000 m^3	3			3
> 500 000 - 1 000 000 m^3	6			6
> 1 000 000 m^3	3			3

The majority of abstractions were from rivers and streams (29) followed by boreholes (10) and dams (9) (Plan12). The annual water volumes abstracted by the 51 users as per the WARMS database range from 300 to 1 525 389m^3/a, with the majority (19) abstracting between 10 000 and 100 000 followed by 11 users abstracting between 0 and 10 000 m^3/a.

Water authority

The DWEA has the overall mandate for the management of the Inkomati WMA. The Komati Basin Water Authority is a bi-national company established in terms of the Treaty on the Development and Utilization of water resources of the Komati River Basin.

Plan 11: Registered water users

2.1.1.8 Groundwater

Conceptual geohydrological model

The natural geohydrological system within the Witbank coal field consists of three superimposed aquifers namely an upper weathered aquifer, a fractured Karoo aquifer and a fractured pre-Karoo aquifer (Hodgson & Krantz, 1998).

The upper weathered aquifer consists of material weathered in situ and transported as part of the erosion process. The depth to weathering is generally between 1m and 15m from surface as stated earlier and the water level varies between 5m and 10m below ground level (mbgl). The flow mechanism within the weathered aquifer is porous flow. The water quality is generally good due to years of dynamic groundwater flow resulting in the leaching of soluble salts.

The fractured Karoo aquifer consists of the various lithologies of siltstone, shale, sandstone and the coal seams. The pores of the geological units are generally well cemented and the principle flow mechanism is fractured flow along secondary structures e.g. faults, bedding plane fractures etc. The intrusion of the fractured aquifer by dolerite dykes and sills has led to the formation of preferential flow paths along the contacts of these lithologies due to the formation of cooling joints. The dykes may act as impermeable or semi-permeable features to impede flow across the dykes.

The fractured pre-Karoo aquifer is separated from the overlying fractured Karoo aquifer by Dwyka tillites which act as an aquiclude where present. The flow mechanism is fracture flow as can be expected from the crystalline nature of the granite rocks. The water quality is generally characterised by high fluoride levels which limits exploitation of this aquifer in combination with the general low yields, deep (expensive) drilling and the low recharge (Grobbelaar et al, 2004).

Mining of the coal seams has resulted in the introduction of an artificial aquifer system which generally dominates the groundwater flow on a local and regional scale.

A geohydrological investigation report is attached in Appendix F.

Hydrocensus

A hydrocensus was conducted by DWA during September 2008 (Plan 11). The purpose of this study was to obtain information on the current hydrogeological baseline of the area, including water quality, water use, volumes used, site condition and the location of each site. Data was collected on the current groundwater users, location of water sources, current water quality and groundwater levels (where possible). A summary of the hydrocensus results can be seen in Table 15.

Table 15: Summary of hydrocensus results taken during September 2008

Site Name	Ycoord	Xcoord	Zcoord	Sampled (Y/N)	Collar Height (m)	Water level (mbgl)	Equipment on Point	Use
BT1	-25.78956	30.04019	1836	Y	-	2.35	Sub. Pump	Domestic & Livestock
BT2	-25.78640	30.03960	1845	N	-	6.61	Wind pump	Domestic & Livestock
BT3	-25.78220	30.03929	1864	Y	-	-	Wind pump	Domestic
BT4	-25.78585	30.03390	1833	Y	0.33	15.41	Sub. Pump	Domestic & Livestock
ZP1	-25.76179	30.00146	1861	N	-	-	None	None
ZP2	-25.77019	30.00165	1822	N	0.35	5.39	Sub. Pump	Domestic
WN1	-25.76746	30.02581	1886	Y	-	-	Sub. Pump	Livestock
WN3	-25.76766	30.02645	1882	Y	-	-	Hand Pump	Domestic
WN4	-25.76746	30.02581	1875	Y	0.38	5.21	Sub. Pump	Livestock
WN7	-25.75434	30.03840	1855	Y	-	9.33	Sub Pump	Domestic

Depth of water table

Water levels observed during field visits and the hydrocensus varied between 2.35 – 15.41mbgl, with the largest percentile being less than 10mbgl see Figure 10.

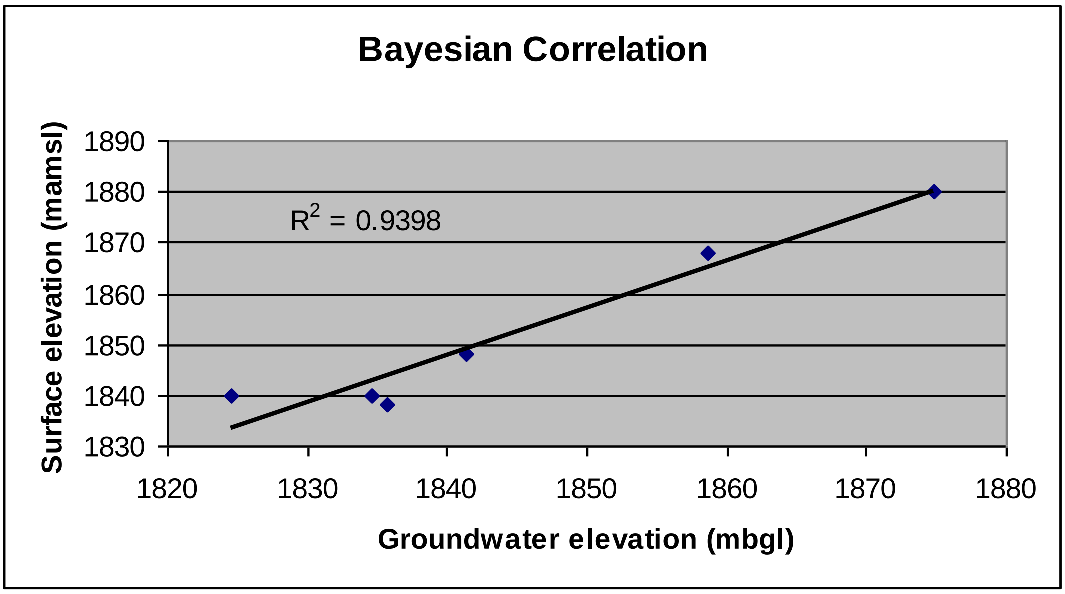


Figure 10: Bayesian correlation showing a strong relationship between water levels and surface elevations

<u>Presence of boreholes and springs and their estimated yields</u>

During the hydrocensus two springs were identified and both were used for domestic and livestock watering however no information regarding yield estimations were available. Information collected during the public consultation process from landowners identified a number of boreholes on and around the planned mining areas mainly used for domestic and agricultural purposes. Reported yields that were abstracted per day were between 2600 – 5000 litres.

Borehole yields in the weathered aquifer are generally low ranging from 0.025l/s – 0.5l/s. Borehole yield statistics for the fractured aquifer in the Ecca sediments show that the yields vary from 0.005l/s – 1.5l/s with an average yield of 0.5l/s (Hodgson & Krantz).

Groundwater quality

Samples were taken during the September 2008 and May 2009 hydrocensus survey and during the environmental assessment of the old Vogelstruispoort Colliery in June 2009 to obtain baseline information. Full macro analysis was done for the samples taken during the sampling runs. The categories of the water types as recorded under natural conditions (baseline status for this study) are shown in the Piper diagram (Figure 11).

Within the South African coal fields, the calcium-magnesium-bicarbonate (left quarter) of the Piper diagram and is characterised by freshly recharged water. The sodium bicarbonate dominant (bottom quarter) is typical of dynamic groundwater flow within the aquifers with the sodium replacing calcium and magnesium in solution. The sodium chloride dominant (right quarter) is associated with stagnant or slow moving groundwater with little or no recharge. The sulphate dominant (top quarter) is typically of water impacted by the oxidation of pyrites which is commonly associated with coal mining activities.

Six of the samples (ZPBH1, BT3, BT4, WN1, WN3 and WN7) fall within the calcium-magnesium-bicarbonate (left quarter) of the Piper plot and is characterised by freshly recharged water. Sample WN4 plots in the right quarter and signifies sodium chloride dominant water. Samples BT1 and VPBH1 indicates sulphate dominant water and is typical of water impacted by the oxidation of pyrites which is commonly associated with coal mining activities.

The Expanded Durov diagram uses similar ratio techniques as the piper diagram to plot the concentrations of the major ions, however six triangular diagrams are used, three for the anions and the for the cations see Figure 12. The expanded Durov is divided into 9 areas, each corresponding to a water type, a brief description is given below in Table 16. In each instance the dominant anions and or cations are given. In certain instances there is no dominance by any particular constituents (area 5) or only dominant anions (area 8).

Table 16: Expanded Durov Legend.

Area 1: Calcium Bicarbonate	**Area 2:** Bicarbonate Magnesium or Calcium Magnesium	**Area 3**: Bicarbonate Sodium
Area 4: Sulphate and/ or Calcium	**Area 5**: No dominant anions or cations	**Area 6:** Sulphate and/or Sodium
Area 7: Chloride and Calcium	**Area 8:** Chloride	**Area 9**: Chloride and Sodium

The majority of the samples plot in the second field indicating bicarbonate magnesium or calcium magnesium dominant water. Sample VPBH1 and BT1 plots in the fifth field showing no dominant anions or cations, where sample WN4 plots in the sixth field signifying sulphate and or sodium water.

In Table 17 it can be seen that the groundwater quality from the samples collected indicate that most of the constituents fall into SANS 241 class 1 (acceptable) with only sample BT1 and sample VPBH1 exceeding the maximum allowable limits for safe drinking water (class 3).

Groundwater use

Data gathered during the field work identified 10 boreholes and of these boreholes 3 are used for domestic and livestock watering, 4 are used for domestic purposes only, 2 for livestock watering and 1 was not in use.

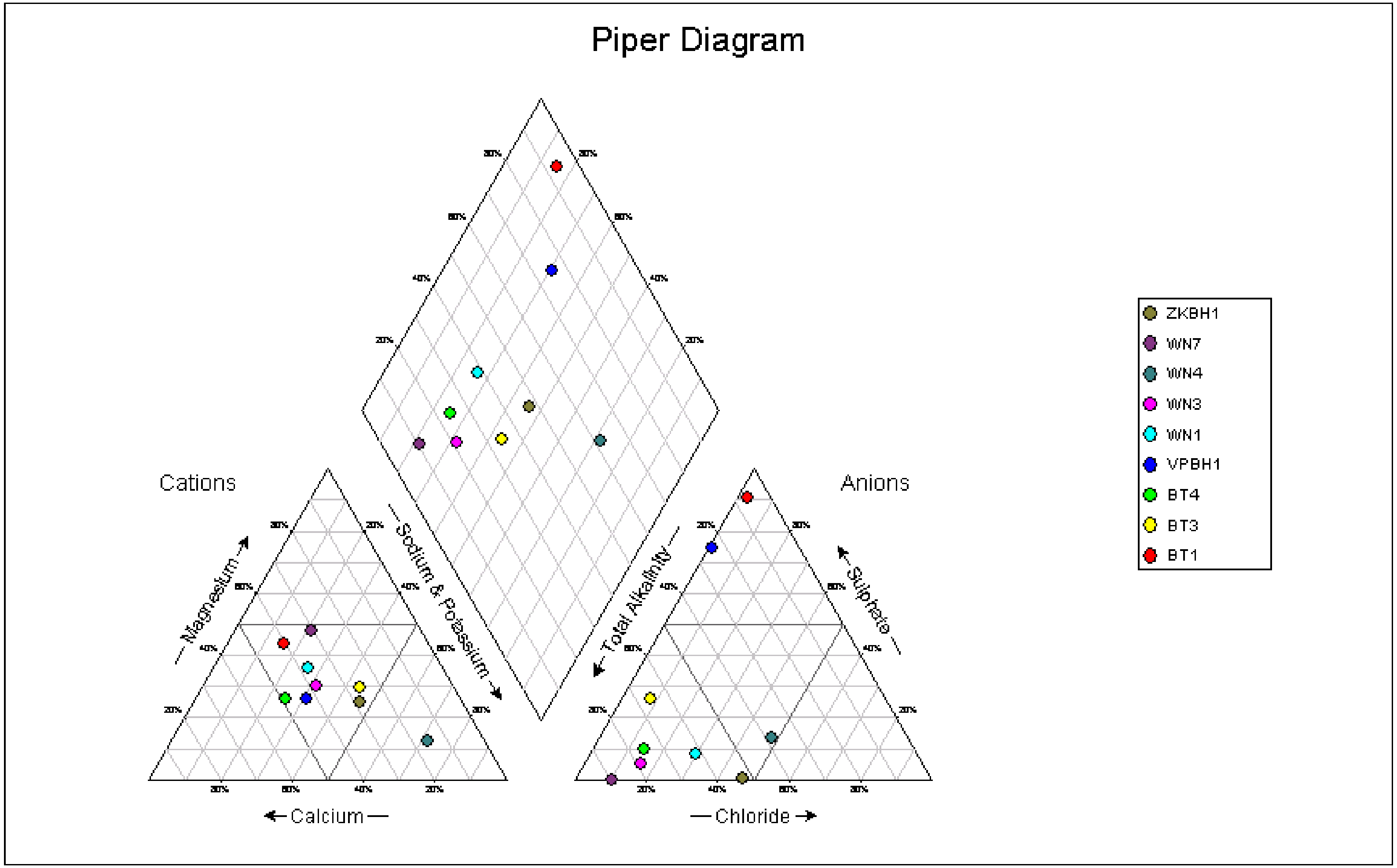


Figure 11: Piper Diagram from the groundwater samples taken during the hydrocensus study.

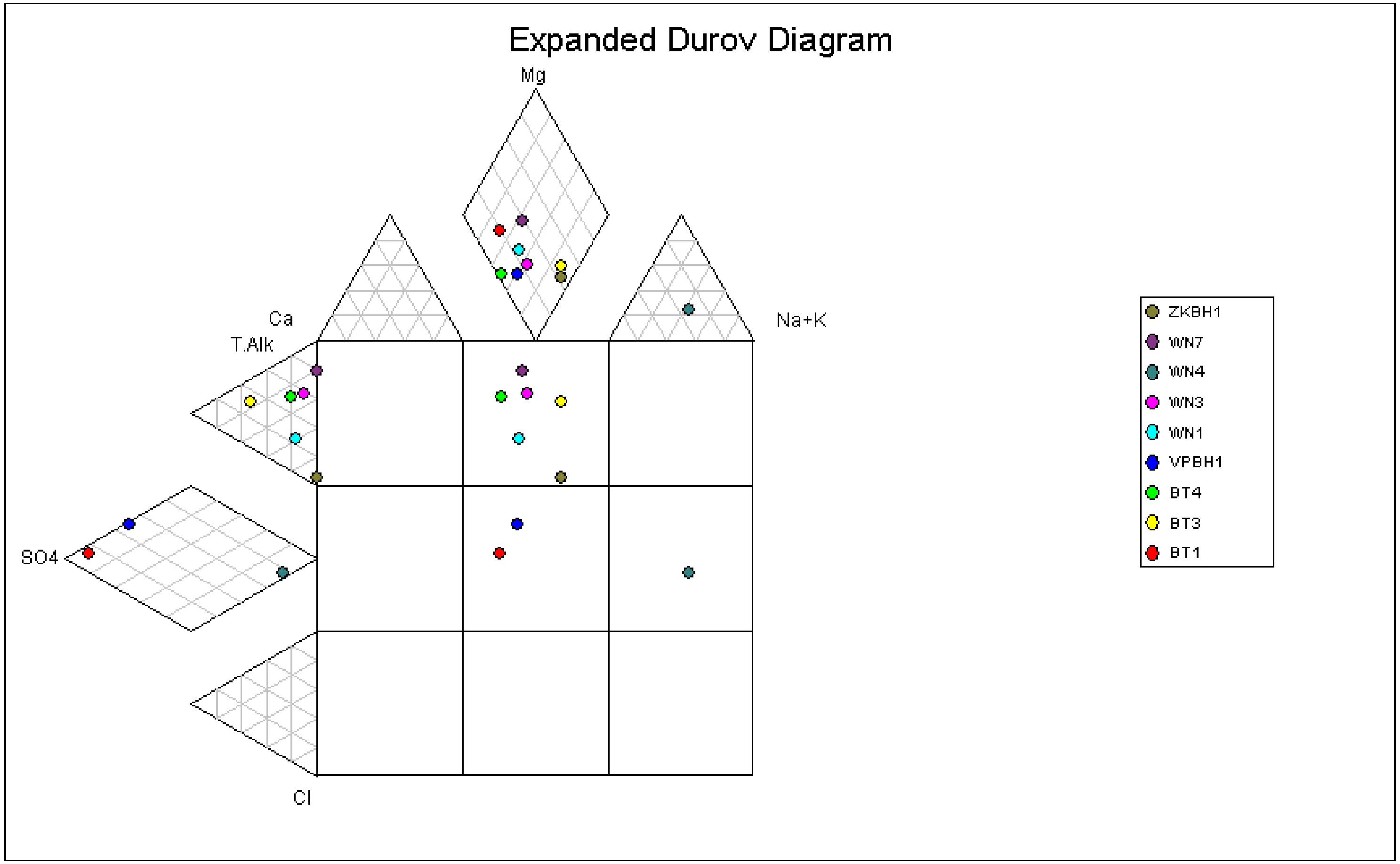


Figure 12: Expanded Durov diagram from the groundwater samples taken during the hydrocensus study

Table 17: Water Quality analysis of borehole samples taken during the Hydrocensus in September 2008

Sample ID		Total Dissolved Solids	Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulphate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al	Free and Saline Ammonia as N
Class 0	(Ideal)	<450	<6.0	<100	N/S	<200	<80	<30	<100	<25	<0.01	<0.05	<70	6.0-9.0	<0.15	N/S
Class I	(Acceptable)	450-1000	6.0-10.0	100-200	N/S	200-400	80-150	30-70	100-200	25-50	0.01-0.2	0.05-1.0	70-150	5-6 or 9.0-9.5	0.15-0.3	N/S
Class II	(Max. Allowable)	1000-2400	>10-20	>200-600	N/S	>400-600	>150-300	>70-100	200-400	50-100	>0.2-2	>0.1-1	>150-370	4-5 or 9.5-10	>0.3-0.58	N/S
Class III	(Exceeding)	>2400	>20	>600	N/S	>600	>300	>100	>400	>100	>2	>1	>370	<4 or >10	>0.58	N/S
BT1	3	260	0.3	4	0	165	25.8	16.9	8.70	4.84	0.04	0.59	41.1	3.62	0.02	1.50
BT3	1	62	0.3	3	34	13	4.96	3.39	5.72	6.53	<0.01	0.06	9.55	6.94	<0.01	0.87
BT4	1	128	0.72	11	82	10.4	19.5	6.40	10.6	1.91	<0.01	<0.01	19.66	7.71	<0.01	0.67
WN1	1	128	0.9	22	65	8.5	14.3	8.31	10.2	2.30	0.63	0.02	19.61	7.42	<0.01	1.8

Sample ID		Total Dissolved Solids	Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulphate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al	Free and Saline Ammonia as N
Class 0	(Ideal)	<450	<6.0	<100	N/S	<200	<80	<30	<100	<25	<0.01	<0.05	<70	6.0-9.0	<0.15	N/S
Class I	(Acceptable)	450-1000	6.0-10.0	100-200	N/S	200-400	80-150	30-70	100-200	25-50	0.01-0.2	0.05-1.0	70-150	5-6 or 9.0-9.5	0.15-0.3	N/S
Class II	(Max. Allowable)	1000-2400	>10-20	>200-600	N/S	>400-600	>150-300	>70-100	200-400	50-100	>0.2-2	>0.1-1	>150-370	4-5 or 9.5-10	>0.3-0.58	N/S
Class III	(Exceeding)	>2400	>20	>600	N/S	>600	>300	>100	>400	>100	>2	>1	>370	<4 or >10	>0.58	N/S
WN3	1	44	0.51	4	28	1.8	5.45	2.65	4.25	1.73	<0.01	<0.01	7.25	6.87	<0.01	0.54
WN4	1	62	2.1	17	19	6.4	3.02	1.45	13.6	3.67	<0.01	0.12	10.28	5.76	<0.01	0.8
WN7	1	60	1.1	4	49	<1.0	6.49	6.15	5.08	0.30	<0.01	<0.01	9.72	7.12	<0.01	0.5
ZPBH1	1	42.00	3.10	8.00	25.00	0.10	4.56	2.44	7.64	1.52	-1.00	2.44	9.07	6.73	-1.00	<0.01
VPBH1	3	1132.00	0.20	7.00	199.00	587.00	129.00	47.60	96.30	17.20	-1.00	47.60	127.00	7.57	-1.00	<0.01

Red Highlighted results = not within SANS 241 - 2005 target water range for drinking water standards

Acid base accounting

Coal deposition is associated with pyrite being formed as the stratum is deposited in a reducing atmosphere. Mining activity will expose the pyrite to oxidising agents such as oxygen and ferric iron. The oxidation processes are as follows (Loos et al, 2000):

- $2FeS2 + 2H2O+7O2 \rightarrow 2FeSO4 + 2H2SO4$ (A)

  (pH >4.5)

- $4FeSO4 + O2 + 2H2SO4 \rightarrow 2Fe(SO4)3 + 2H2O$ (B)

  (abiotic at pH>4.5; biotic at pH<2.5)

- $Fe2(SO4)3 + 6H2O \rightarrow 2Fe(OH)3 + 3H2SO4$ (C)

  (pH > 2.5)

- $FeS + 14 Fe3+ + 8H2O \rightarrow 15Fe2+ + 2SO42- + 16H+$ (D)

The above equations lead to the formation of acidic conditions and the subsequent water quality deterioration due to heavy metal transport and salt loading, as the buffering capacity of the natural rock is utilised. Process (A) is an abiotic process occurring at a pH >4.5 due to spontaneous oxidation of the pyrite. Process (B) is the transformation of ferrous sulphate to ferric sulphate. This is an abiotic process when pH>4.5, but slows down and becomes biotic at pH < 4.5. At a pH below 2.5 the biotic process is most prominent. Process (C) produces ferric hydroxide (yellow boy), and further lowers the acidity. The abiotic process (D) then leads to the oxidation of the pyrite with the ferric iron product of process (B).

Process (B) is the rate limiting process in this mechanism. This process requires oxygen, therefore, the prevention of oxygen ingress and the creation of reducing conditions within the workings is crucial to slow down the oxidation of pyrite and the resulting low pH conditions.

Acid Base Accounting (ABA) include the neutralising potential (NP) of the formations will buffer the mine water and in cases where the NP significantly exceeds the acid potential (AP) this will lead to an increase in dissolved salts and neutral water quality. Acidic conditions with high salt loading are possible where the buffering capacity is insufficient or the reaction rated for neutralising are such that they cannot neutralise the acid generated.

The generation of poor quality water from mine workings is characterised by low pH, high heavy metal content and high salts or a neutral pH and high salt content. Acidic mine water rich in heavy metals is termed Acid Mine Drainage (AMD).

ABA results at Weltevreden Colliery

Core samples were analysed by INNOV-X AFRICA specialising in X-ray fluorescence (XRF) technologies to investigate the concentration of sulphur within the overburden. It should be noted that this is only to obtain an approximate idea of the AP of the host rock and all results will have to be verified once the ABA testing have been completed.

XRF is a spectroscopic method that is commonly used for solids in which secondary X-ray emission is generated by excitation of a sample with X-rays. The X-rays eject inner-shell electrons and outer-shell electrons take their place and emit photons in the process. The wavelength of the photons depends on the energy difference between the outer-shell and inner-shell electron orbital. Limits of Detection (LOD) are measured in parts per million (ppm). Actual limits of detection depend upon specific sample types, and presence of interfering elements within the sample. The results from the XRF analysis concluded that only three of the lithologies had sulphur levels above the LOD.

The results from the XRF analysis can be seen in Table 18.

Table 18: XRF results from the two core boreholes drilled for ABA testing.

Reading	Lithology	Sulphur (ppm)	Calcium (ppm)	Manganese (ppm)	Iron (ppm)
Borehole 1					
1	Laterite	<LOD	516	63	6376
2	Mudstone	<LOD	859	54	5343
3	Mudstone	<LOD	853	63	68458
4	Banded Shale	<LOD	757	147	4134
5	Banded Shale	<LOD	2438	2651	4369
6	Banded Shale	<LOD	1540	1084	20130
7	Banded Shale	<LOD	1914	900	106662

Reading	Lithology	Sulphur (ppm)	Calcium (ppm)	Manganese (ppm)	Iron (ppm)
8	Banded Shale	<LOD	873	222	79578
9	Banded Shale	<LOD	1552	476	64358
10	Vitrinitic coal	10689	909	39	25349
11	Sandstone	<LOD	914	40	47964
12	Sandstone	4081	2273	378	7322
23	Sandstone	<LOD	2592	86	3120
14	Banded sandstone	<LOD	4346	719	31440
15	Banded sandstone	<LOD	2006	1030	4229
16	No 2 Coal seam	<LOD	59840	255	56378
17	No 2 Coal seam	<LOD	29074	168	43961
Borehole 2					
18	Sandstone	<LOD	529	<LOD	266
19	Sandstone	<LOD	<LOD	41	5127
20	Sandstone	<LOD	494	<LOD	1145
21	Mudstone	<LOD	<LOD	232	120845
22	Sandstone	<LOD	780	63	3325
23	Shale	<LOD	920	58	7960
24	Banded sandstone	<LOD	1982	1615	51827
25	Banded sandstone	<LOD	3279	3189	92948
26	Banded sandstone	<LOD	<LOD	76	2395
27	No 2 Coal seam	4782	1149	92	10265
28	No 2 Coal seam	<LOD	925	35	1159

** parts per million (ppm)*

Six samples were submitted to SGS Lakefield for ABA analyses.

The main advantages of static tests are that they are quick to perform and quantitative results on acid, base and leaching parameters are obtained.

In addition to pH measurements, the actual acid and base potential of the No.2 coal seam and overburden has been determined.

The main advantages of static tests are that they are quick to perform and quantitative results on acid, base and leaching parameters are obtained. The ABA criteria for interpretation can be seen in Table 19.

Table 19: Modified Acid Base Accounting criteria for interpretation

TYPE I	Potentially Acid Forming (Strong AGP)	Sulphide > 0.3%, negative net NP (< -20), NP/AP ratio <1
TYPE II	Intermediate (Medium AGP)	Sulphide > 0.2 %, Negative net NP (> - 20),NP/AP ratio <1
TYPE III	Non-Acid Forming (Low AGP)	Sulphide < 0.3 %,Low NP, Negative net NP ,NP/AP ratio <1
TYPE IV	Uncertain (Possible AGP or NP)	Low AP, Low NP, NP/AP RATIO BETWEEN 1&3
TYPE V	Low NP	Sulphide < 0.1%, Low NP
TYPE VI	Medium NP	Sulphide <0.5%, Positive net NP(> 10), NP/AP ratio > 3
TYPE VII	Strong NP	Strongly positive net NP(>20), NP/AP ratio > 4, High Carbonate

The following results were obtained from the ABA testing (Table 20-Table 23). It can be seen that sample VPSS1 and sample VPSS3 indicate a low potential for acid generation. Sample VPSS2 show an uncertain potential for both acid generation and neutralisation potential.

Table 20: Samples analysed according to these broad categories

Acid Generation Potential (AGP)	Sample ID	General reason for classification (with some exceptions)
Low AGP	VPSS1 and VPSS3	Sulphide > 0.3%, negative net NP (< -20), NP/AP ratio <1
Uncertain possible AGP or NP	VPSS2	

** The NP on these samples may be underestimated due to possible stored acidity, as indicated by a paste pH value of less than 5.5.*

The ABA test results can be seen in Table 21.

Table 21: ABA Test Report for Weltevreden

Sample ID	0602	0603	0604	0605	0606	0607
Fizz Rating	1	1	1	1	1	1
Paste pH	6.8	6.7	7.1	7.0	6.8	7.7
Sample Weight(g)	2.00	1.98	1.98	1.98	1.98	2.00
Normality HCl (N)	0.108	0.108	0.108	0.108	0.108	0.108
Total HCl added (ml)	35.2	20.0	39.3	20.0	31.0	20.0
Normality NaOH (N)	0.100	0.100	0.100	0.100	0.100	0.100
Total NaOH added (ml)	32.5	19.7	34.0	18.7	29.8	20.5
NP	13.8	4.8	21.3	7.3	9.3	2.7
AP	0.63	1.56	0.31	1.56	0.31	0.31
Net NP	13.2	3.2	21.0	5.8	9.0	2.4
NP/AP	22.1	3.1	68.2	4.7	29.7	8.8
Total S(%)	0.09	0.07	0.09	0.07	0.05	<0.01
Sulphide S (%)	0.02	0.05	0.01	0.05	<0.01	<0.01
SO_4 (%)	0.20	0.05	0.25	0.06	0.13	<0.03
CO_3 (%)	0.19	0.19	0.36	<0.05	0.30	<0.05

The handheld XRF did not indicate a major abundance of sulphur (indicating pyretic material) within the coal seam or the overburden on the two boreholes drilled.

One of the four samples that have a low NP (0607) is associated with the coal measure which will be mined as a result of the proposed mining project. The remaining three samples having a low NP is associated with the overburden, in particular the sandstones and banded sandstones. These strata are therefore most likely to be geochemicaly inert and not participate in acidification but low neutralisation reactions.

The two samples with a medium NP both exhibit very low AP values, but with higher NP values leading to the classification of medium NP. These are associated with the vitrinitic coal and the banded shales. These samples are expected to provide a neutralising potential to the geochemical environment.

It should be understood that the modified ABA test method only provide an indication of the potential for acid generation. The presence of AMD at the neighbouring Vogelstruispoort property could still indicate the potential to produce an acidifying effluent over the long-term (post closure) at Weltevreden if not properly managed. The Vogelstruispoort property is an abandoned opencast mine with substantial quantities of coal fines left unrehabilitated. The water quality indicates an elevated TDS and neutral pH indicating acidification that is currently being neutralised. The environment could acidify should the neutralising potential be exhausted.

Northern Coal sent coal samples from the No. 2 seam to Midlab CC. in Middelburg during 2008 for analysis. It was found that there is a tendency of quality differences regarding the upper, middle and lower portions of the seam in individual intersections. However, this tendency could not be confirmed over the entire area.

The overall quality of the total No.2 coal seam is summarised in

Table 22.

The yield of the prime coal shows potential around the centre of the prospecting area and yields of up to 34.9 % were analysed with a mean of approximately 25%. The middling coal was analysed with a mean of approximately 55 % for the same area.

Table 22: Summary of the total No. 2 Seam Coal Characteristics (Air dried)

RD	Yield %	CV MJ/kg	Ash %	Volatiles %	Fixed Carbon %	Sulphur %
Raw	96.7	15.69	42.27	17.99	36.89	2.81

Several factors calculated in ABA by Soregaroli and Lawrence (1998) indicated that for sustainable long-term acid generation, at least 0.3% sulphide-S is needed. Values lower than 0.3% can yield acidy but it is only of short-term significance. From the results calculated in the above table it can be seen that the No.2 coal seam at Weltevreden have a high acid generating potential and further studies need to be conducted to determine the neutralisation potential of the surrounding host rock. It needs to be taken into consideration that the No.2 coal seam will be mined out and only small percentage will remain.

Old Vogelstruispoort Colliery ABA results

Soil samples were collected during the environmental assessment of the old Vogelstruispoort Colliery (Plan 11). The colliery is located in close proximity of the planned mining area. Affected landowners requested that further studies be undertaken to assess the extent of environmental degradation at Vogelstruispoort. The soil samples were sent to SGS laboratory in Johannesburg for past and static acid rock drainage testing.

Table 23: ABA results – Test method EPA ABA (Lawrence)

Sample ID	VPSS1	VPSS1	VPSS1
Fizz Rating	1	1	1
Paste pH	4.3	4.4	6.0
Sample Weight(g)	2.01	2.00	1.98
Normality HCl (N)	0.112	0.112	0.112

Total HCl added (ml)	20.0	20.0	20.0
Normality NaOH (N)	0.101	0.101	0.101
Total NaOH added (ml)	24.1	19.7	21.9
NP	-4.8	6.3	0.7
AP	2.50	4.38	2.19
Net NP	-7	1.9	-1.5
NP/AP	-1.9	1.4	0.3
Total S (%)	0.08	0.14	0.07
Sulphide S (%)	0.52	0.19	1.48
SO_4 (%)	1.32	0.15	4.21
CO_3 (%)	0.25	0.08	<0.05

There possibly is a high variability of the overburden and interburden at Weltevreden and the fact that only two boreholes were drilled and tested for ABA will only provide a preliminary understanding of the possible acid generating or neutralisation potential of the geology.

The results indicate a low potential of acid generation, however observations and sampling of a nearby old Vogelstruispoort Colliery (un-rehabilitated) did show acid formation and poor quality water. Weltevreden need to understand that even if results in this report indicate that acid generation potential is low, the risk will always remain and need to be monitored during the life of mine.

2.1.1.9 Air quality

A complete Air Quality Impact Assessment is attached in Appendix G.

Regional air quality

Air quality is an issue of concern in Mpumalanga, as it is in many other parts of South Africa. Several air pollution sources exists in Mpumalanga, ranging from veld fires to industrial processes, agriculture, mining activities, power generation, paper and pulp processing, vehicle use and domestic use of fossil fuels (Mpumalanga Province, 2002). Different pollutants are associated with each activity, ranging from volatile organic compounds and heavy metals through to dust and odours. (http://www.mpu.agric.za/htm).

The identification of existing sources of emission in the region, and the characterisation of ambient pollutant concentrations is fundamental to the assessment of the potential for cumulative impacts and synergistic effects given the proposed operation and its associated emissions. A comprehensive emissions inventory has not been completed for the region to date. The establishment of such an inventory is not within the scope of the current study. The source types present in the area and the pollutants associated with such source types are noted with the aim of identifying pollutants which may be of importance in terms of cumulative impact potentials.

The Mpumalanga Highveld (formerly known as the Eastern Transvaal Highveld) has frequently been the focus of air pollution studies for two reasons. Firstly, elevated air pollution concentrations have been noted to occur in the region itself. Secondly, various elevated sources of emission located in this region have been associated with long-range transportation of pollutants and with the potential for impacting on the air quality of adjacent and more distant regions (Piketh, 1994).

The proposed site does not fall within the Highveld Priority Area as declared by the Minister of Environmental Affairs and Tourism in terms of section 18(1) of the National Environment Management: Air Quality Act, Act No.39 of 2004 (NEM:AQA).

Local air quality

The dust fallout levels in the area are impacted on by the farming activities, as well as vehicle activity on the gravel roads. The harvesting of maize during the dry windy season contributes substantially to air born particulates.

Strategic analysis

Risk-Based Decision Making

A risk-based approach is adopted in this study. Risk based decision making (RBDM) is a process that organizes information about the possibility for one or more unwanted outcomes to occur into a broad, orderly structure that helps decision makers make more informed management choices. More simply stated, RBDM asks the following questions and uses the answers in the decision-making process:

- What can go wrong?
- How likely are the potential problems to occur?
- How severe might the potential problems be?
- Is the risk of potential problems tolerable?
- What can/should be done to lessen the risk?

A tiered approach is used in this strategy, where the level of detail in the risk assessment will be proportionate to the nature and complexity of the risk to be addressed.

Meteorology

Meteorological data for the region was obtained from the SAWS station located in Belfast. Data was obtained for the 2007 year. The Belfast weather station is the closest automated weather station to the proposed site (~5 km away) and was deemed adequately representative of meteorological conditions for the region.

The atmospheric dispersion model (AERMOD) was simulated over a 10km x 10km area over DEM topography of the local terrain. The proposed mine is located in the centre of the modelling domain which stretches 10 000m horizontally and 10 000m vertically. These extents form the boundaries of the modelling domain into which all emission outputs will be stacked and plotted.

Source Emission Quantification

In order to establish an emissions inventory for modelling of the expected process contribution to baseline conditions at the proposed site, fugitive sources of particulate emissions from the proposed Northern Coal Weltevreden Project were quantified (more detail is available in Appendix G). These are summarized in Table 24 below, accounting for each of the individual mining operations.

Table 24: Northern Coal Weltevreden Project Emissions Inventory (tonnes per annum)

Source	PM10	TSP
Loading Truck with Overburden	13.60	28.80
Loading Truck by shovel or FEL	13.44	27.84
Bulldozing Coal	284.70	893.52
Bulldozer on Overburden	35.04	148.92

Truck Unloading Overburden	4.13	11.52
Truck Unloading Coal	4.03	9.60
Drilling	3.96	7.54
Blasting	37.54	72.19
Dust generated from Unpaved Roads	93.44	377.66
Crushing	0.26	0.58
Screening	1.06	1.73
Miscellaneous Transfer and Conveying	0.15	0.31
Wind erosion from Active Stockpiles	35.04	70.08
Total:	526.39	1650.28

Survey results and dispersion model

H.E.C.S Laboratory Services cc provided baseline dust deposition (dust fall-out) data for use in this assessment. Five predetermined bucket locations were sampled (for 30 day periods) over a four month duration (October 2008 - January 2009):

- Site 1 - (S25° 46.11.9’ E030°00.22.7’);
- Site 2 - (S25° 47' 27.504" E030°0' 43.299");
- Site 3 - (S25° 46.47.2’ E030°01.09.0’);
- Site 4 - (S25° 46.10.0’ E030°02.03.6’); and
- Site 5 - (S25° 47.20.9’ E030°02.18.1’).

In terms of dust deposition standards, the results are assessed according to SANS1929:2005 “Ambient Air Quality – Limits for common pollutants”. SANS 1929:2005 guidelines use a four-band scale (Table 25 as well as target, action and alert thresholds to evaluate the recorded dust levels.

Table 25: Four-band scale evaluation criteria for dust deposition (After SANS 1929: 2004)

Band Number	Band Description Level	Dust fall rate (D) (mg.m^2.day, 30 day average)	Comment
1	Residential	D < 600	Permissible for residential and light commercial.
2	Industrial	600 < D <1,200	Permissible for heavy commercial and industrial.
3	Action	1,200 < D <2,400	Requires investigation and remediation if two sequential months lie in this

			band, or more than three occur in a year.
4	Alert	2,400 < D	Immediate action and remediation required following the first incidence of dust fall rate being exceeded. Incident report to be submitted to the relevant authority.

Table 26: Target, action and alert thresholds for dust deposition (After SANS 1929: 2004)

Level	Dust fall rate (D) (mg.m^2.day, 30 day average)	Averaging Period	Comment
Target	300	Annual	N/A
Action Residential	600	30 days	Three within any year, no two sequential months.
Action Industrial	1200	30 days	Three within any year, not sequential months.
Alert Threshold	2,400	30 days	None. First incidence of dust fall rate being exceeded requires remediation and compulsory report to the authorities.

A project or operation may submit a request to the authorities to operate within Band 3 (action band, as outlined in Table 27) for a limited period, provided that this is essential in terms of the practical operation of the enterprise (for example the final removal of a tailings disposal) and provided that an appropriate control technology is applied for this duration. No margin of tolerance should be granted for operations that result in dust fall rates, which fall within alert band (Band 4) as specified in Table 27 and Table 28.

Exceptions pertaining to these standards include the dust fall that exceeds the specified rates but that can be shown to be the result as some extreme weather or geological event shall be discounted for the purpose of enforcement and control. Such an event might typically result in excessive dust fall rates across an entire metropolitan region, and not be localised to a particular operation. Additionally, natural seasonal variations, for example the naturally windy months each year, will not be considered extreme events for this definition. Dust fall out was collected on site and from the surrounding areas (Plan 13).

The table below represents the dust fallout levels for the period October 2008 to July 2009. The dust monitoring station NOC 2 was only placed on site in June. NOC 1 was stolen in the beginning of January that is why there is no data for January 2009 and February 2009. The rest of the monitoring stations were sampled for the entire period as stated above. The dust levels are represented in Figure 13.

Table 27: Baseline Dust deposition mg/m2/day at Receptor Level

Discrete receptors	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Ave
NOC1	72	273	205	N/A	N/A	209	315	111	67	51	163
NOC2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	57	190	124
NOC3	196	359	273	138	166	402	413	107	124	148	233
NOC4	56	263	839	379	66	376	349	121	1100	272	382
NOC5	16	434	211	117	67	211	463	119	103	144	189

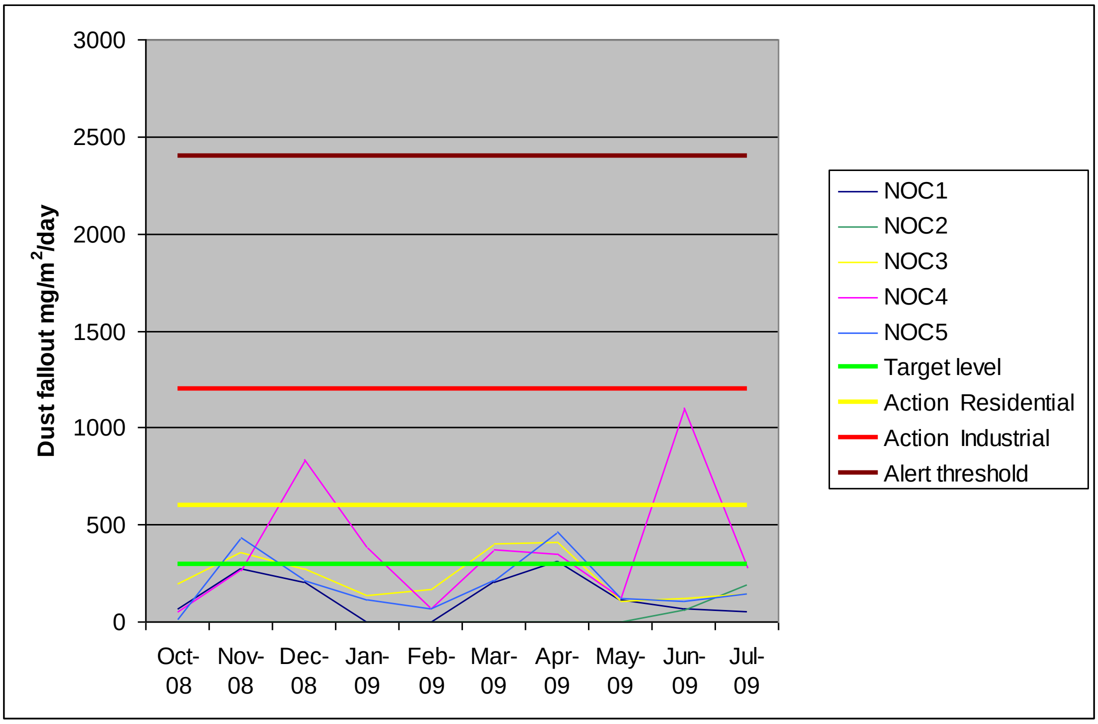


Figure 13: The dust fallout levels from October 2008 to July 2009-06-12

The results indicate that most of the dust levels of the specific monitoring stations are below the target levels according to SANS 1929:2005 guidelines. NOC 4 had the highest levels in December 2008 and June 2009; the reason for the spikes in the trend could have been caused by an irregular event.

As for the rest of the monitoring period some levels are slightly higher than the target range during November 2008, March 2009 and April 2009. The overall trends of the dust fallout levels indicate that the fallout levels in the area are low.

Predicted air quality dispersion

Figure 14 to Figure 22 illustrate the predicted dispersion of PM10 contribution from the project and dust fall out. The dispersion model takes into account all components of dust generation for the calculation, including dust generated from blasting. Included is the change in dispersion if mitigation is undertaken. In terms of mitigation, fictitious scenarios of 0%, 50% and 90% effectiveness in dust suppression are presented. The specific means of mitigation are not discussed, as it is up to the mine to decide which mitigation methods they want to employ, and the Air Quality specialist has no control over. However should they mitigate with effectiveness in the 50%-90% range, which is very reasonable, the scenarios created are perfectly feasible, and representative. Please note that the following figures are not to scale and the scaled illustrations can be found in the complete specialist report attached in Appendic G.

Isopleths shown are the relevant PM10 reference standard concentrations, as predicted by the atmospheric dispersion model. The illustrated values are 50 µg/m3, 75 µg/m3 and 180 µg/m3 – i.e. the SANS 1929:2005 Target, SANS 1929:2005 Limit and NEMAQA reference standards for short term, 24 Hour (Daily exposure) for PM10 respectively (refer Tables 2-4 in Appendix G).

Plan 12: Dust fall out monitoring points

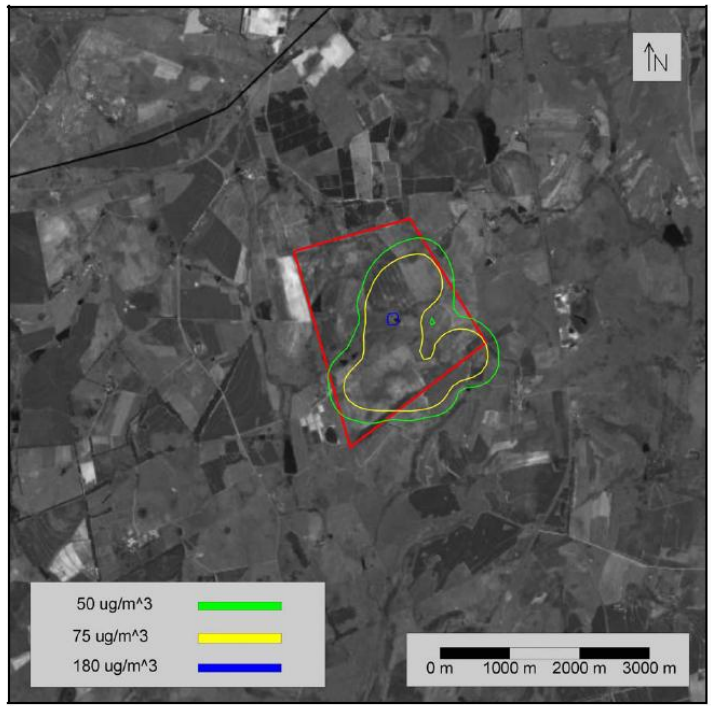


Figure 14: Predicted Process Contribution PM10; 24 Hour Exposure (0% mitigation)

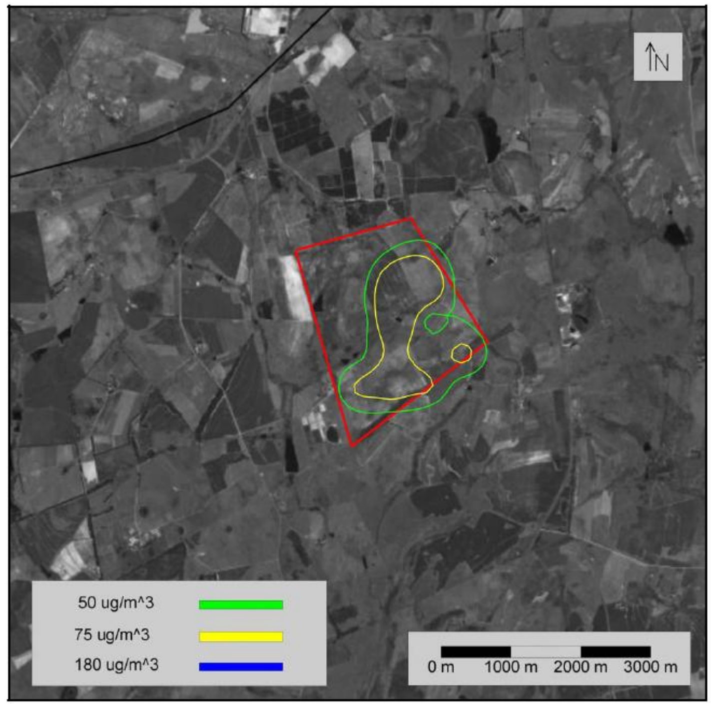


Figure 15: Predicted Process Contribution PM10; 24 Hour Exposure (50% mitigation)

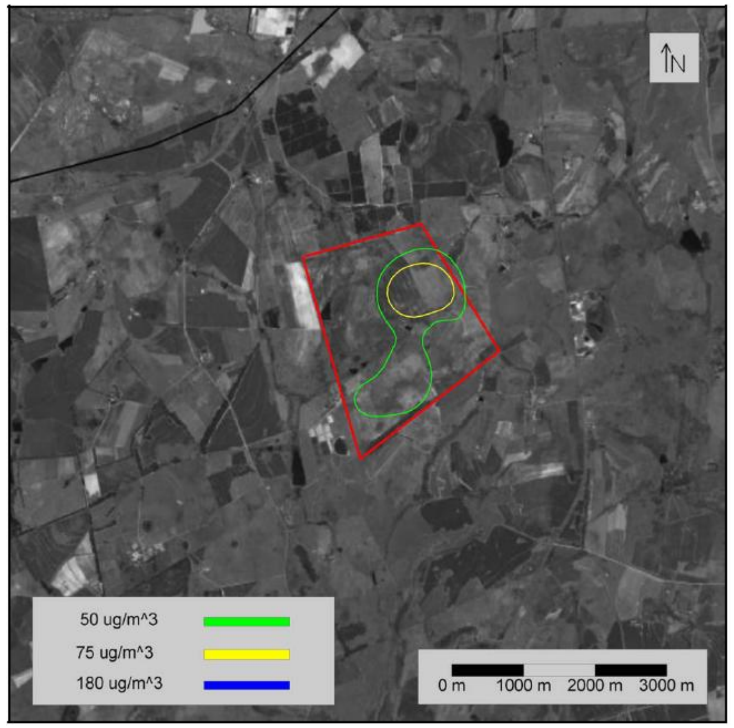


Figure 16: Predicted Process Contribution PM10; 24 Hour Exposure (90% Mitigation)

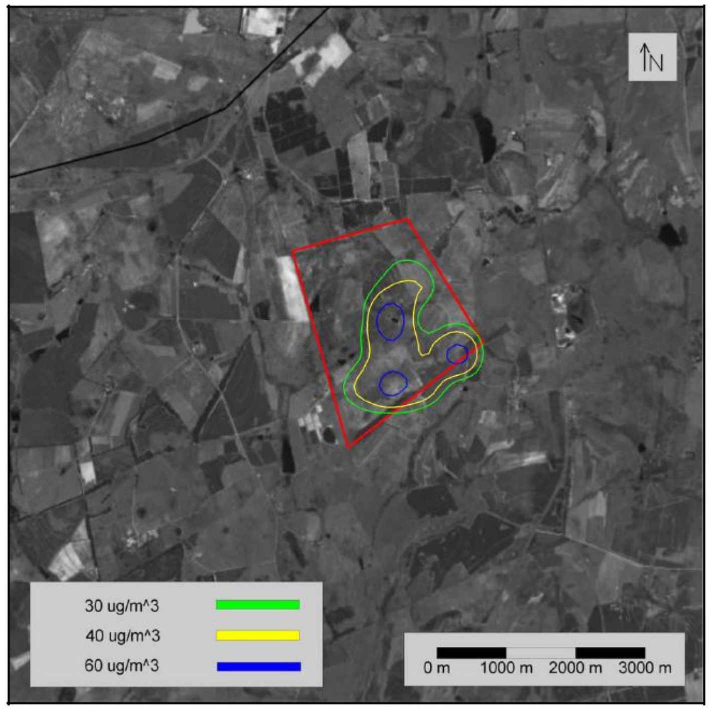


Figure 17: Predicted Process Contribution PM10; Annual Exposure (0% mitigation)

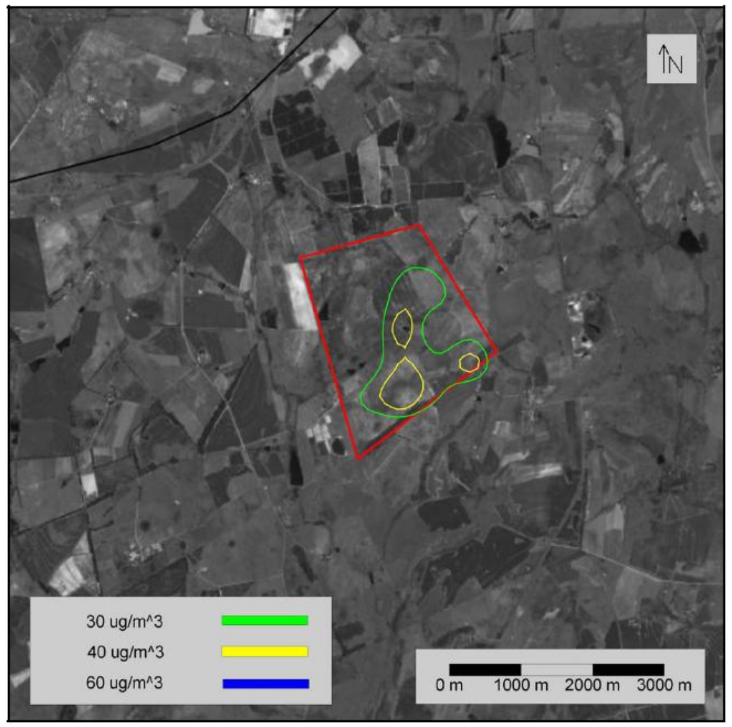


Figure 18: Predicted Process Contribution PM10; Annual Exposure (50% mitigation)

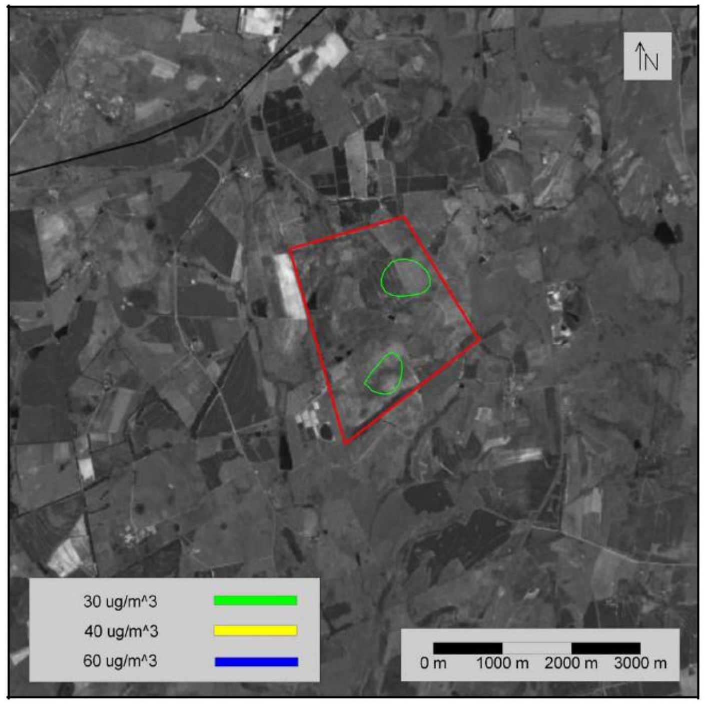
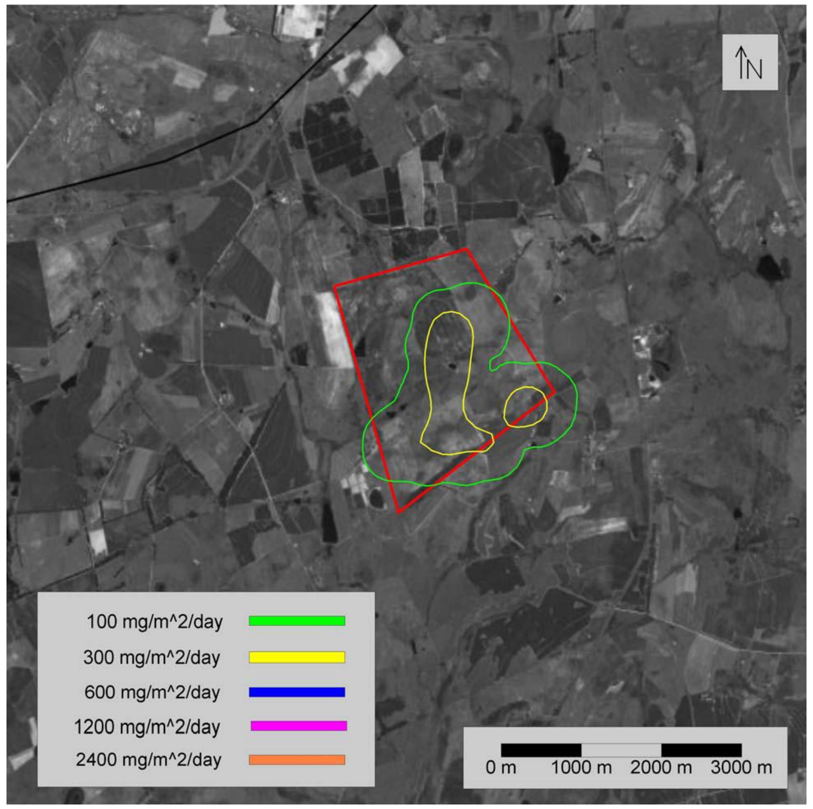


Figure 19: Predicted Process Contribution PM10; Annual Exposure (90% mitigation)



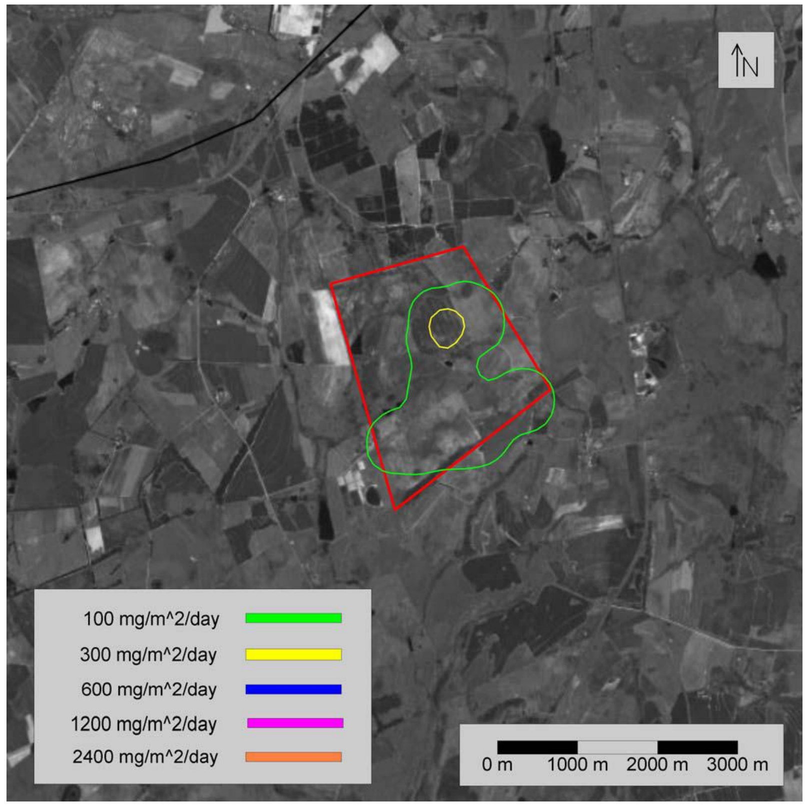


Figure 20: Predicted Process Contribution fallout dust; Annual Exposure (0% mitigation) Figure 21: Predicted Process Contribution fallout dust; Annual Exposure (50% mitigation)

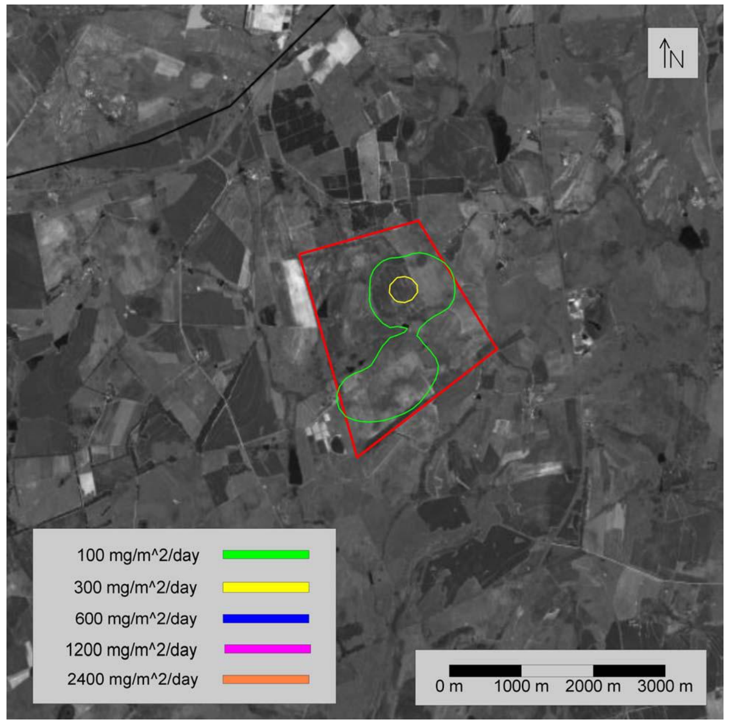


Figure 22: Predicted Process Contribution fallout dust; Annual Exposure (90% mitigation)

2.1.1.10 Noise

The approach used in investigating noise impacts is based on guidelines provided by SANS 10103:2008. In accordance to the SANS 10103:2008 guidelines, the sound pressure levels are often used as the measurement unit for noise guideline.

The noise monitor used was a Quest Model 1200 Precision Integrated Sound Level Meter and was calibrated (calibration certificates are available on request).

A list of identified receptors within the 2km range where noise measurements were taken is presented in Table 28. The location of where the noise levels were sampled can be seen on Plan 13.

Table 28: Identified noise receptors

Code	Farm	Portion	Owner	Figure
WN1	Weltevreden 381 JT	15	Mr W Pretoius	1 & 2
WN2	Weltevreden 381 JT	2	Mr W Pretoius	3 & 4
WN3	Vogelstruispoort 384 JT	1	Mr Potgieter	5 & 6
WN4	Blyvooruitzicht 383 JT	4	Mr Kotze	7 & 8
WN5	Zoekop 426 JS	4	Mr Viljoen	9 & 10
WN6	Zoekop 426 JS	8	Mr Gerrits	11 & 12
WN7	Zoekop 426 JS	10	Mr Pretorius	13

With the close proximity of receptor WN7 to the proposed mining activities it is predicted that the specific receptor will be impacted on considerably, therefore full day and night time measurements were taken at receptor WN7 during a weekend (includes Saturday and Sunday) and weekday. Daytime measurements were taken for 16 hours between 06:00 – 22:00 and night time measurements were taken for 8 hours between 22:00 – 06:00.

<u>Results</u>

The results of the baseline environmental noise measurements taken during the day and night time on a weekday are presented in Table 29 below and measurements taken during the day and night time on a weekend are presented in Table 30.

Table 30**Plan 13: Noise sampling points**

Table 29: Results of baseline environmental noise measurements taken during a weekday

Sample ID	SANS Rating Limit Rural districts (dB)	Measurements Period LAeq,t (dB)	Maximum (dB)	Minimum (dB)	Date & Time
Daytime measurement					
WN1	45	37.1	49.6	30.9	09/03/09 09:30 -10:30
WN2	45	39.4	51.2	31.5	09/03/09 11:30 -12:30
WN3	45	49.8	67.6	33.2	09/03/09 13:00 -13:47
WN4	45	41.1	59.6	30.8	09/03/09 17:00 -17:48
WN5	45	36.3	57.2	30.4	09/03/09 18:00 -18:45
WN6	45	40.3	59	32.1	10/03/09 08:00 -09:00
WN7	45	55.1	87.6	29	22/06/09 06:00 -22:00
Night time measurement					
WN1	35	36.7	44.5	31.2	26/03/09 00:50 -01:20
WN2	35	45.4	53.4	40.6	26/03/09 01:25 -01:55
WN3	35	46.9	51.9	37.4	25/03/09 22:00 -22:30
WN4	35	43.7	52.6	37.1	25/03/09 22:35 -23:05
WN5	35	44.7	53	35.2	26/03/09 00:07 -00:37
WN6	35	35.3	48.3	32.1	25/03/09 23:30 -00:00
WN7	35	36.6	65.4	30	22/06/09 22:00 -06:00
	Indicates LAeq,t levels above either the Daytime noise limit or the Night time noise limit				

Note: *LAeq,T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time period of not less than 30 minutes. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.*

Table 30: Results of baseline environmental noise measurements, taken during a weekend

Sample	SANS Rating Limit	Measurements Period			
ID	Rural districts (dB)	LAeq,t (dB)	Maximum (dB)	Minimum (dB)	Date & Time
Daytime measurement					
WN1	45	48.7	54.7	41.6	22/03/09 11:45 -12:45
WN2	45	44.3	57.6	31.8	22/03/09 18:15 -18:45
WN3	45	50.1	66	29.9	22/03/09 13:00 -14:00
WN4	45	39	55.6	30.6	22/03/09 14:30 -15:30
WN5	45	40.3	53.2	32.3	22/03/09 17:00 -18:00
WN6	45	41.7	62.7	30.6	20/06/09 06:00 -22:00 & 21/06/09 06:00 -22:00
WN7	45	45.9	75.9	28.3	22/03/09 15:45 -16:46
Night time measurement					
WN1	35	42.3	45.2	32.8	23/03/09 01:00 -01:30
WN2	35	34.6	39.4	33	23/03/09 01:35 -02:05
WN3	35	30.2	50	28.4	22/03/09 22:00 -22:35
WN4	35	31.5	39.4	30.3	22/03/09 23:00 -23:30
WN5	35	43.1	51.9	36.7	22/03/09 23:45 -00:15
WN6	35	40.4	47.4	35.6	23/03/09 00:20 -00:50
WN7	35	43.6	68.5	37.6	20/06/09 06:00 -22:00 & 21/06/09 06:00 -22:00
	Indicates LAeq,t levels above either the Daytime noise limit or the Night time noise limit				

***Note**: LAeq,T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time period of not less than 30 minutes. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.*

Sample point WN1:

The sample was taken on the south western border of the proposed site, which is on portion 16 of the farm Weltevreden 381 JT, near the farmhouse of Mr Pretorius residing on portion 10 of the farm Zoekop 426 JS. The daytime Leq level measured 43.7dB during the weekday and 48.7dB during the weekend. The weekday measurement is below the limit of 45dB for rural districts and weekend measurement is slightly above. There was no apparent noise source that caused the weekend measurement to be slightly above the limit for rural districts.

The night time Leq level measured 36.7dB during the weekday and 42.3dB during the weekend. Both measurements are above the night time limit for rural districts. The cause of the slightly high level may be attributed to the noise generated by the *Kassina senegalensis* (Bubbling Kassina) and *Semnodactylus wealii* (Rattling frog), as well as the high pitch sound made by the *Orthoptera spp*. (Crickets) in the area.

Sample point WN2:

The sample was taken at the farmhouse on portion 2 of the farm Weltevreden 381 JT. The daytime Leq level measured 39.4 dB during the weekday and 44.3 dB during the weekend, both measurements are below the daytime limit for rural districts.

The night time Leq level measured 45.4 dB during the weekday and 34.6 dB during the weekend. The weekday measurement is above the night time limit for rural districts. There was no apparent noise source that caused the weekend measurement to be slightly above the limit for rural districts.

Sample point WN3:

The sample was taken at the farmstead of Mr Potgieter, who resides on portion 1 of the farm Vogelstruispoort 384 JT. The daytime Leq level measured 49.8dB during the weekday and 50.1dB during the weekend. Both measurements are above the limit of 45dB for rural districts. The cause of the high level may be attributed to the noise generated by the vehicular activity on the R33, which runs adjacent to the property.

The night time Leq level measured 46.9 dB during the weekday and 30.2dB during the weekend. The cause of the high level of the weekday measurement may be attributed to the noise generated by the vehicular activity on the R33. The potential reason for the difference between the weekday and weekend measurement taking during the night time may be attributed to the reduction in vehicular activity on the R33 over weekend periods.

Sample point WN4:

The sample was taken at the residence of Mr Kotze, residing on portion 4 of the farm Blyvooruitzicht 383 JT. The daytime Leq level measured 41.1dB during the weekday and 39dB during the weekend, both measurements are below the daytime limit for rural districts.

The night time Leq level measured 43.7dB during the weekday and 31.5dB during the weekend. The weekday measurement is above the night time limit for rural districts. The cause of the level during the weekday may be attributed to the noise generated by the vehicular activity on the R33, which is located 670 meters to the east of the farmstead.

Sample point WN5:

The sample was taken at the residence of Mr Viljoen, who resides on portion 4 of the farm Zoekop 426 JS. The daytime Leq level measured 36.3dB during the weekday and 40.3dB during the weekend both measurements are below the daytime limit for rural districts.

The night time Leq level measured 44.7 dB during the weekday and 43.1 dB during the weekend both measurements are above the night time limit for rural districts. The cause of the high level may be attributed the high pitch sound made by the *Orthoptera spp*. (Crickets) in the area as well the noise generated by the *Kassina senegalensis* (Bubbling Kassina) and *Semnodactylus wealii* (Rattling frog).

Sample point WN6:

The sample was taken at the residence of Mr Gerritz, who resides on portion 8 of the farm Zoekop 426 JS. The daytime Leq level measured 40.3dB during the weekday and 41.7dB during the weekend both measurements are below the daytime limit for rural districts.

The night time Leq level measurement was 35.3dB during the weekday and 40.4 dB during the weekend. The weekend measurement is slightly higher than the night time limit for rural districts. The cause of the slightly higher level may be attributed to the constant barking of the small dog on the property.

Sample point WN7:

The sample was taken at the residence of Mr Pretorius who resides on portion 10 of the farm Zoekop 426 JS. The daytime Leq level measured 55.1dB during the weekday and 45.9 dB during the weekend, the weekday measurement are above the both the daytime limit for rural districts and the weekend measurement was equal to the daytime limit. The cause of the high level during the weekday may be attributed to the birdsong on the farmstead.

The night time Leq level measured 36.6dB during the weekday and 43.6dB during the weekend. Both the measurements are slightly higher than the night time limit for rural districts. There was no apparent noise source that caused the levels to be above the night time limit.

Based on the results from the baseline environmental noise measurements it is noted that the day time ambient noise levels in and around site are between 36dB and 50dB during the weekday measurements, and between 39dB and 51dB during the weekend measurements, ranging from within the acceptable outdoor rating levels for ambient noise in a rural district to slightly above. The reason of the Lreq,t levels being above the acceptable range limit may be attributed to noises associated with the vehicular activity on the R33, especially influencing the levels at receptor points WN3 and WN4 and noises associated with bird song during the daytime, especially influencing the levels at receptor point WN7.

The night time ambient noise levels in and around site are between 35dB and 47dB during the weekday measurements and between 30dB and 44dB during the weekend measurements, ranging from within the acceptable outdoor rating levels for ambient noise in a rural district to slightly above. The reason of the Lreq,t levels being above the acceptable range limit may be attributed to the noise generated by a dog barking at receptor point WN6, noise generated by *Kassina senegalensis* (Bubbling Kassina) and *Semnodactylus wealii* (Rattling frog), as well as the high pitch sound made by the *Orthoptera spp*. (Crickets), which are common in the area.

2.1.1.11 Blasting and vibration

Blast Management & Consulting (BM&C) completed a Blasting Assessment Report for the proposed Weltevreden Project. The complete report is attached in Appendix I.

The expected ground vibration and air blast levels from blasting operations required at the Weltevreden Project was calculated and considered in relation to the surrounding structures and installations. Some concerns were identified from review of the expected ground vibration and air blast levels. These concerns are however manageable and in no way such that blasting should be prohibited. The main concerns are related to distance between the mining area and the nearest structures – house located on portion 10 of Zoekop 426 JS & house on portion 17 of Blyvooruitzicht 383 JT. Expected levels of ground vibration and air blast are within the allowed limits but levels are such that it could be perceptible. This in turn may lead to complaints and subsequent investigations. Ground vibration levels at the closest houses are 10 and 19.9 mm/s respectively for the largest charge mass applied. Considering the reduced charge modelled, this will have a decreased ground vibration effect and reduce the risk significantly. This is within the general safety limit of 25mm/s. All other structures / installations were well within limits with no significant effect. Mitigation in reducing the maximum charge mass per delay and design of blasts in the areas of portion 10 of Zoekop 426 JS & portion 17 of Blyvooruitzict 383 JT will assist to control the ground vibration.

Air blast levels reviewed showed no direct concern with regards to damage to structures, but did indicate that mitigation of the ground vibration will also bring about reduced air blast levels. Maximum level observed was 126dB at the nearest house. This is within accepted norm of 134dB. In some areas the levels could be perceptible but possible damage to the nearest structures is low and is not expected to be problematic. Reduced charges and control on stemming will assist in reducing the possibilities of complaints from home owners. Levels of air blast required to induce damage are in order of 145dB and greater. Air blasting normally generates rattling of roofs which could be easily misjudged by house owners as ground vibration.

The following is a summary of main elements that need to be taken into consideration:

There is no actual specific South African standard for ground vibration – none developed,

The USBM criteria is generally accepted throughout South Africa as an applicable standard,

In order to finalise actual allowed limits a thorough structural survey should be done in order to determine actual conditions of structures and only then can alternatives be suggested,

BM&C apply a principle of reduced levels where structures of poor design and build are present and the actual locations are known in relation to the blasts,

The Blasting Assessment Report describes worst case scenarios where blasting is done on the edge of the mine, distance between actual blast and structure will always need to be considered,

In many cases we need to draw on work done by other researchers internationally as well, blasting principles throughout is the same, The Blasting Assessment Report provided is an initial review of possible impacts. Actual will be dependent on what is finally conducted in the drill and blast departments.

Review of applicability of the USBM Criteria for safe blasting:

Back ground and basis to the USBM standard:

Cracking from blasting blasts occur where excessive stresses and strains are produced within the planes of the walls or between walls at the corners. Vibration in the corners is assumed to indicate cracking potential, because it corresponds to whole-structure response. Midwall motions are primarily responsible for window sashes rattling, picture frame tilting, dishes jiggling. Three factors of Structural Response are important (Structural response is directly and linearly proportional to ground vibration amplitude): Amplitude, duration of blast and frequency of vibration Controlling Structural Response by adjusting the three factors is achieved as follows:

- Amplitude: Reduce vibration by 1/2, Reduce response by ½;
- Frequency: Double the frequency, Reduce response by as much as 10 times; and
- Duration: Reduce duration, Reduce response.

(How much depends on both duration and frequency)

The above ground portion of each structure will respond more than the ground when excited at its natural frequency. Amplification is a comparative measure of the maximum structure response to ground velocity (GV) at the same point in time. Amplification occurs when the motion becomes larger than that at GV. Amplification varies for typical and atypical structures. When the ground vibration frequency is significantly higher than that of the structure the motion is equal to that of the ground.

Natural frequency and damping are the most important structure response characteristics. Ground vibrations below the fundamental frequency of the house will still cause the house to vibrate at least as much as the ground. If the frequency of the ground vibration is more than 40% greater than the fundamental frequency of the house however, the house will vibrate less than the ground. The USBM also determined that while houses vibrate as a single-degree-of-freedom between 4 and 12 Hz, the natural frequency of the house's midwall tends to occur between 12 and 20 Hz. In order to control the response of a structure that has more than one fundamental frequency, you must control the two lowest fundamental frequencies. For residential structures this means minimizing ground vibrations between 4 and 20 Hz. Damage potentials for low-frequency blast (<40 Hz) are considerably higher than those for high-frequency blasts (>40 Hz).

Most significant for blasting is that the principal frequencies of the ground motion almost always equal or exceed the gross structure natural frequency of 4 to 10 Hz. Little difference in natural frequencies are observed among 1- and 1 ½-story homes; that of 2-story homes are lower. The relatively higher frequencies in 1-stroy homes with natural frequencies nearer 10 Hz are more damage-prone than taller 2-stroy homes with natural frequencies near 5 Hz.

Concluding to the use of the USBM

Considering the amplitude and frequency of blast induced ground vibration the resulting effects on structures is dependent on the natural frequency of a structure. The research work done that led to the USBM criteria for safe blasting was based on work from various researchers and a variety of structures are included. Work includes research on typical American build houses but also that of brick and mortar, reinforced constructions and brick and concrete structures. Thus considering that similar structures than South African build structures were also considered in the making of the USBM criteria it can be accepted as a standard in view of no formal South African standard. Typical South African structures are within the same range of natural frequencies as that described above. Thus the USBM standard will also be applicable.

Applicable standard to mud houses

In view of the non existence of a standard the following is applicable to mud houses. It is recommended that peak velocities continue to be the primary measure of ground motion to assess the damage potential to resident-type structures and for regulatory purposes. When ground vibration is a concern near mud houses, the limits are reduced by halve than to those of brick or masonry and concrete structures. Even in view of this, levels greater than described have been observed at mud houses without inducing damage.

Weather conditions and air blast

Air blast is relatively strong sources of midwall vibrations and poor sources of corner (whole structure racking) vibration. Air blast is often responsible for the secondary rattling and annoyance effects produced by midwall motions (perpendicular to the planes of the wall surface). There are mainly three factors of interest regarding air blasts as discussed in the main report. Weather has an influence on the propagation of air blast. It is not always possible to define the exact influence as weather changes and the extent to test for all situations is nearly impossible. Aspects considered in tests done were: humidity, wind and wind direction, temperature, atmospheric pressure. Two atmospheric conditions were found to be most significant: Temperature inversions and wind (both direction and speed) and humidity less significant. Both these aspects can increase air blast levels above what would be expected. Additional air blast energy is not produced, only the distribution is affected. Research work done found that an impulsive sound level of 140dB is a reasonable threshold for glass. Again no formal South African standard exists on airblast. The recommended USBM level of 134 dB again will be applicable. Airblast all round is the same and glass is similar. There is no reason not to use this as a standard.

Blast Management & Consulting also as other consultants in this field knows that weather conditions will influence the airblast levels. Thus always the recommendations that blasting should not be done early morning or late afternoon when air is still cold are cooling down again – specifically in winter or when it is overcast or when wind is blowing towards a point of concern. These conditions could enhance the effect of airblast with negative responses.

Plan 14: Ground vibration and air blast (maximum charge)

2.1.1.12 Natural vegetation / plant life

A complete Flora and Fauna Survey Report is attached in Appendix J.

Description of site specific vegetation

Mpumalanga province is divided into 6 main areas of sensitivity, namely

- Highly Significant;
- Important & Necessary;
- Irreplaceable;
- Least Concern;
- No Natural Habitat Remaining; and
- Protected Areas (Lötter 2007).

This study area is classified as Least Concern and No Natural Habitat Remaining.

Description of dry season plant communities

The dry season results yields two main vegetation types, i.e. *Bidens pilosa-Hyparrhenia hirta* grassland and *Zea mays-Themeda triandra* maze fields (Table 31). The yellow highlighted areas represent the plant communities for each species group.

Table 31: Phytosociological table for Weltevreden dry season survey.

Survey Plots	1	2	3	4	5	6	7	8	9	10	11	12	13
Species Group A													
Hyparrhenia hirta	4	4	2a	3	3	3	2m	.	3	.	2a	.	.
Verbena bonariensis	.	3	3	3	1	.	3	1	3	3	1	1	.
Bidens pilosa	2m	3	2b	3	.	1	.	1	3	2m	.	.	3
Panicum natalense	.	.	3	3	2m	2m	3	.	2a	.	3	.	.
Sporobolus africanus	3	3	.	2a	4	.	.	2a	4	3	4	3	.
Species Group B													
Stenotaphrum secundatum	2a	3	.	.	3	.	.	.	.	.	.	.	.
Sporobolus pyramidalis	2b	3	.	.	.	.	2a	.	.	.	.	.	.
Cymbopogon excavatus	4	3	3	.	.	.	.	.	.	.	.	.	.
Species Group C													
Cynodon dactylon	1	2a	.	.	3	.	1	.	2a	.	.	.	.
Pseudognaphalium luteo-	.	2a	.	.	.	.	.	.	.	.	.	.	.

Survey Plots	1	2	3	4	5	6	7	8	9	10	11	12	13
album													
Eragrostis curvula	3	2a	.	2a	.	.	.	.	.	.	.	1	.
Species Group D													
Berkheya setifera	2a	.	.	.	.	.	.	.	.	.	.	1	.
Setaria sphacelata v. sphacelata	3	.	.	.	.	.	.	.	.	.	.	.	.
Eucalyptus camaldulensis	2m	.	.	.	.	.	.	.	.	.	1	.	.
Species Group E													
Bewsia biflora	.	2a	.	3	.	.	3	.	.	.	.	.	.
Aristida junciformis	.	.	3	2a	.	.	.	.	.	.	.	.	.
Eragrostis gummiflua	.	3	.	3	.	.	.	.	.	.	.	.	.
Pennisetum clandestinum	.	3	3	2a	2a	.	4	1	2a	1	.	3	.
Species Group F													
Eragrostis racemosa	.	.	.	.	3	4	.	.	.	.	.	.	.
Eragrostis superba	.	.	.	.	.	2a	.	.	.	.	.	.	.
Helichrysum kraussii	.	.	.	.	.	2m	.	.	.	.	.	.	.
Stoebe vulgaris	.	.	.	.	.	3	.	.	.	.	1	.	.
Species Group G													
Acacia mearnsii	.	.	.	.	.	.	2b	.	.	.	1	2a	.
Pinus patula	.	.	.	.	.	.	.	.	.	2a	1	1	.
Panicum maximum	.	.	.	1	2a	.	.	1	.	.	.	3	.
Zea mays	.	.	.	.	.	.	.	.	4	3	.	3	4
Themeda triandra	.	3	.	.	.	.	.	.	2a	.	3	4	.
Tagetes minuta	3	.	.	.	.	.	.	.	3	.	.	1	3
Datura stramonium	.	.	.	.	.	.	.	.	.	2a	1	2 m	2a
Hypoxis hemerocallidea	.	.	.	.	.	.	1	1	1	.	2a	2a	.
Species Group H													
Cyperus longus	.	.	.	.	.	.	.	2a	2m	3	.	.	.
Schoenoplectus corymbosus	.	.	.	.	.	.	.	3	.	.	.	.	.
Setaria sphacelata	.	.	.	.	.	.	3	1	3	2a	.	.	.
Imperata cylindrica	.	.	.	.	.	.	.	3	.	.	.	.	.
Solanum sisymbrifolium	.	.	.	2b	.	.	.	2a	.	2m	.	.	.
Miscanthus junceus	.	.	.	.	.	.	.	.	3	3	.	.	.
Species Group I													
Gerbera piloselloides	.	.	.	.	.	.	.	.	.	.	2b	.	.
Helichrysum rugulosum	.	.	.	.	.	.	.	.	.	.	3	.	.
Stachys aethiopica	.	.	.	.	.	.	.	.	.	.	2a	.	.

Survey Plots	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Gerbera ambigua	.	.	.	.	.	.	.	.	.	.	1	.	.
Oxalis obliquifolia	.	.	.	.	.	.	.	.	.	.	1	.	.
Species Group J													
Helichrysum aureonitens	.	1	.	.	.	.	.	.	.	.	.	3	.
Boophane disticha	.	.	.	.	.	.	.	.	.	.	.	2a	.
Haplocarpha scaposa	.	.	.	.	.	.	.	.	.	.	.	1	.
Species Group K													
Gomphrena celosioides	.	.	.	.	.	.	.	.	.	.	.	.	2b
Species Group L													
Nicandra physalodes	.	.	.	.	.	.	.	.	1	.	.	.	.
Andropogon huillensis	1	.	.	.	.	.	.	.	.	.	.	.	.
Pogonarthria squarrosa	.	.	.	1	.	.	.	.	.	.	.	.	.
Sutherlandia montana	.	.	.	.	.	.	1	.	.	.	.	.	.
Elephantorrhiza elephantina	1	.	.	.	.	.	.	.	.	.	.	.	.

The dendrogram below shows how the communities are divided and sub-divided.

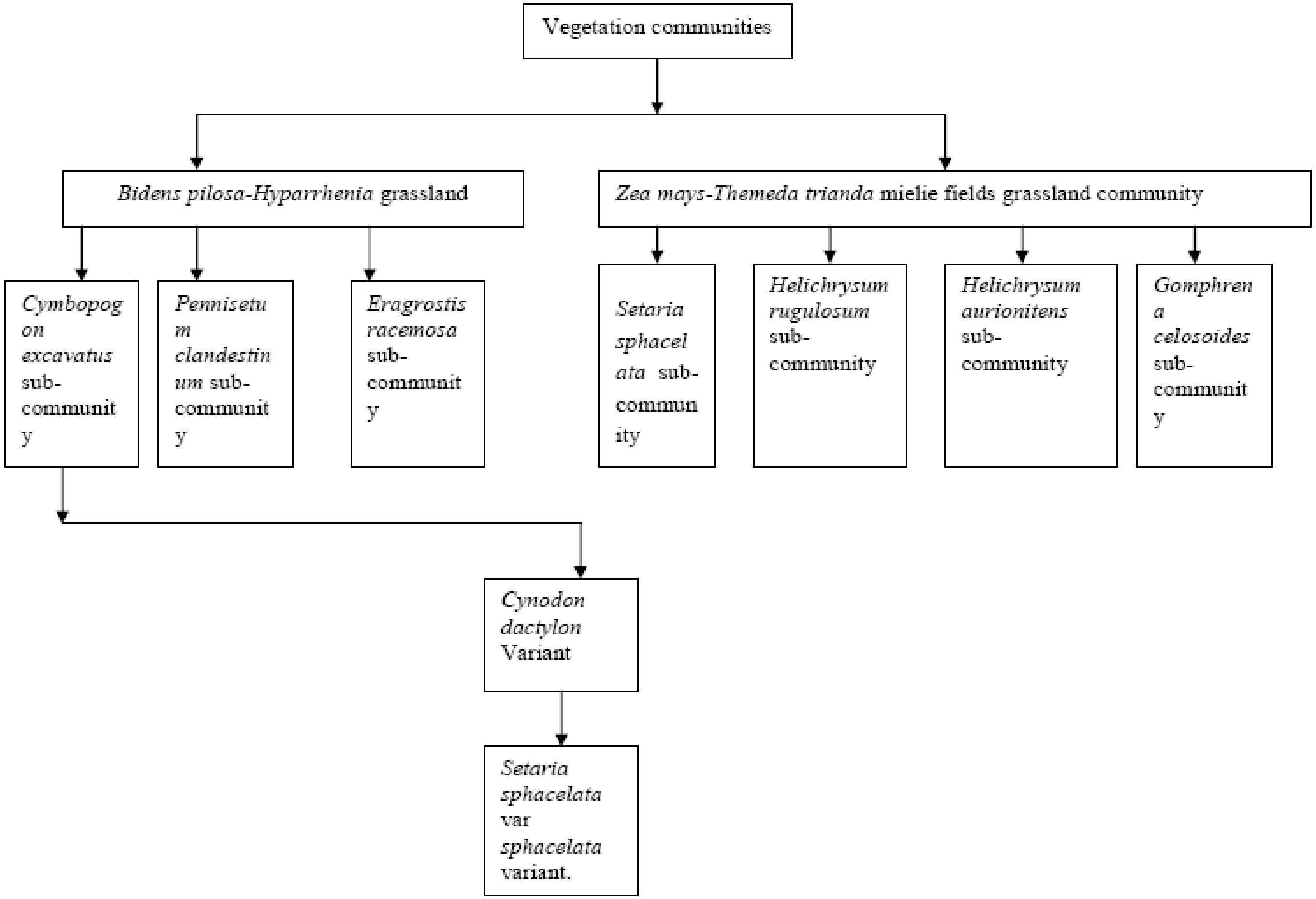


Figure 23: Dendrogram showing the cut-levels for vegetation communities in Weltevreden during the dry

Bidens pilosa-Hyparrhenia hirta grassland

This grassland community is found in areas where the vegetation is highly disturbed. The diagnostic species are the invasive alien plants such as *Bidens pilosa* and *Verbena bonariensis*. Most of the herbs found in this grassland are mainly alien invasive.

The diagnostic species of this community are the grasses, *Sporobolus africanus* and *Panicum natalense,* and the herbs such *Verbena bonariensis* and *Bidens pilosa* (Species Group A).

The prominent grasses are *Sporobolus pyramidalis* (Species Group B), *Eragrostis curvula* (Species Group C), and *Pennisetum clandestinum* (Species Group E).

The herbaceous layer is dominated by species such as *Berkheya setifera* (Species Group D), alien invasive *Stoebe vulgaris* (Species Group F), *Tagetes minuta, Zea mays*, (Species Group G), *Helichrysum rugulosum* (Species Group I). The tree layer is dominated by the alien invasive *Pinus patula* (Species Group G).

This grassland community is sub-divided into three sub communities and two variants, namely *Cymbopogon excavatus* sub-community, *Pennisetum clandestinum* sub-community, *Eragrostis racemosa* sub-community and *Cynodon dactylon* Variant and S*etaria sphacelata var sphacelata* variant.

Cymbopogon excavatus sub-community

This sub-community is found in flat grasslands areas. The diagnostic species are grasses such as *Sporobolus pyramidalis* and *Stenotaphrum secundatum* (Species Group B).

The prominent species are the grasses *Hyparrhenia hirta, Sporobolus africanus* (Species Group A), *Eragostis curvula* (Species Group C), *Setaria sphacelatha var sphacelatha* (Species Group D), and *Eragrostis gummiflua* (Species Group E).

Cynodon dactylon Variant

This variant is found in highly disturbed and in flat areas. This variant is characterised by Species Group C. The diagnostic species are *Eragrostis curvula* and *Pseudognaphalium luteo-album.*

The prominent species in the grass layer are Sporobolus africanus, Hyparrhenia hirta (Species Group A), Sporobolus pyramidalis, Cymbopogon excavatus and

Stenotaphrum secundatum (Species Group B), Setaria sphacelatha var sphacelatha (Species Group D), and Eragrostis gummiflua (Species Group E), Themeda triandra (Species Group G).

The herbaceous layer is dominated by species such as *Bidens pilosa* (Species Group A), *Berkheya setifera* (Species group D), *Tagetes minuta*, (Species Group G).

The tree layer is dominated by *Eucalyptus camaldulensis*.

<u>Setaria sphacelata var sphacelata variant</u>

This variant is characterised by Species Group D. The diagnostic species are *Berkheya setifera*, and *Eucalyptus camaldulensis.*

The dominant species are the grasses *Hyparrhenia hirta* (Species Group A), *Sporobolus pyramidalis*, *Cymbopogon excavatus and Stenotaphrum secundatum* (Species Group B), *Abdropogon huilensis* (Species Group L).The herbaceous layer is dominated by species such as *Bidens pilosa* (Species Group A), *Tagetes minuta*, (Species Group G), and *Elephantorhiza elephantine* (Species Group L).

<u>Pennisetum clandestinum sub-community</u>

This sub community is also found in highly disturbed grasslands and is represented by Species Group E. The diagnpostic species are *Eragrostis gummiflua*, *Bewsia biflora*, and *Aristida junciformis.*

The dominant species in the grass layer are Hyparrhenia hirta, Panicum natalense, Sporobolus africanus (Species Group A), Sporobolus pyramidalis, Cymbopogon excavatus and Stenotaphrum secundatum (Species Group B), Eragostis curvula, Pseudognaphalium luteo-album, Cynodon dactylon (Species Group C), Eragrostis racemosa (Species Group F), Panicum maximum, Themeda triandra (Species Group G). The herbaceous layer is dominated by species such as Bidens pilosa, Verbena bonariensis (Species Group A) and Solanum sisymbifolium (Species GroupH).

<u>Eragrostis racemosa sub-community</u>

This sub-community is Species Group F. The diagnostic species are *Eragrostis superba, Helichrysum kraussii* and *Stoebe vulgaris.* The prominent species in this grass layer are *Hyparrhenia hirta* and *Panicum natalense* (Species Group A),

There are no species in the herbaceous layer.

Zea mays-Themeda triandra mielie fields

This community is found next to the maze fields. It is characterised by Species Group G with the diagnostis species being the grasses *Panicum maximum* and *Themeda triandra* and the herbs such as *Zea mays, Tagetes minuta, Datuta stramonium, and Hypoxis hemerocallidea*.

The prominent grasses are Hyparrhenia hirta, Panicum natalense, Sporobolus africanus (Species Group A), Cynodon dactylon (Species Group C), Bewsia biflora, Pennisetum clandestinum (Species Group E), Setaria sphacelata and Imperata cylindrica (Species Group H). The herbaceous layer is dominated by pilosa, Verbena bonariensis (Species Group A), Cyperus longus, Solanum sisymbifolium (Species GroupH), Gerbera piloselloides, Helichrysum rugulosum, Stachys aethiopica, Helichrysum aurionitens, Boophane disticha (Species Group I) and Gomphrena celosoides (Species Group K).

This community is dived into four sub-communities, namely Setaria sphacelata sub-community, Helichrysum rugulosum sub-community, Helichrysum aurionitens sub-community, and Gomphrena celosoides sub-community.

Setaria sphacelata sub-community

This sub-community is found in grassland areas and is characterised by Species Group H. The diagnostic species are the grasses Setaria sphacelata, Imperata cylindrica and the herbs such as Cyperus longus, Solanum sisymbifolium and Miscanthus junceus.

The prominent species in the grass layer are Hyparrhenia hirta, Panicum natalense, Sporobolus africanus (Species Group A) Cynodon dactylon (Species Group C) Pennisetum clandestinum (Species Group E). The herbaceous layer is dominated by Bidens pilosa, Verbena bonariensis, Bidens pilosa (Species Group A), Zea mays (Species Group C), Themeda triandra, Datura stramonium and Hypoxis hemerocallidea (Species Group G). The tree layer is dominated by Acacia mearnsii and Pinus patula (Species Group G).

Helichrysum rugulosum sub-community

This sub-community is characterized by Species Group I. The diagnostic species are Gerbera piloselloides, Stachys aethiopica, Gerbera ambigua, and Oxalis obliquifolia.

The prominent species in grass layer are *Hyparrhenia hirta*, *Panicum natalense*, *Sporobolus africanus* (Species Group A) and *Themeda triandra (*Species Group G). The herbaceous layer is dominated by *Stoebe vulgaris* (Species Group F), *Datura stramonium* and *Hupoxis hemerocallidea* (Species Group G). The tree layer is dominated by *Eucalyptus camaldulensis* (Species Group D), and *Acacia mearns*ii (Species Group G).

Helichrysum aurionitens sub-community

This sub-community is characterized by Species Group J. The diagnostic species are *Boophane disticha* and *Haplocarpha scaposa.*

The prominent species in grass layer are *Sporobolus africanus* (Species Group A), *Eragrostis curvula* (Species group C), *Pennsisetum clandestinum* (Species Group E), *Panicum maximum* and *Themeda triandra* (Species Group G).

The herbaceous layer is dominated by Verbena bonariensis (Species Group A), Berkhera setifera (Species Group D), Zea mays, Tagetes minuta, Datura stramonium and Hypoxis hemerocallidea (Species Group G).

The tree layer is dominated by *Acacia mearnsii*, and *Pinus patula* (Species Group G).

Gomphrena celosoides sub-community

This sub-community is characterized by Species Group K. It is only species that charaterized this group. It is found in highly disturbed and overgrazed areas.

No grasses are prominent in this group.

The herbaceous layer is dominated by *Zea mays, Tagetes minuta,* and *Datura stramonium* (Species Group G).

A dry season survey was also completed on the farm Zoekop neighbouring to the proposed site. The findings of the survey are included in the Flora and Fauna Report attached in Appendix J.

Description of wet season plant communities

The wet season survey is divided into two main grasslands vegetation types (Table 32), namely *Tristachya leucothrix-Monocymbium ceresiiforme* grassland and *Setaria sphacelata v. sphacelata- Hyparrhenia hirta* grassland. The two main grassland communities will be discussed in detail below. Plan 16 illustrates the deiniation of the identified plant communities identified on Weltevreden.

Table 32: Phytosociological table for Weltevreden wet season survey

Survey Plots	12	10	6	11	2	1	4	3	5	7	8	9
Species Group A												
Bidens bipinnata	3	.	.	.	.	.	.	.	.	.	.	.
Melinis nerviglumis	2b	.	.	.	.	.	.	.	.	.	.	.
Species Group B												
Typha capensis	.	4	.	.	.	.	.	.	.	.	.	.
Setaria pumila		2b	.	.	.	.	.	.	.	.	.	.
Cyperus esculentus	.	3	.	.	.	.	.	.	.	.	.	.
Bothriochloa radicans	2b	2b	.	.	.	.	.	.	.	.	.	.
Species Group C												
Berkheya setifera	.	.	.	3	.	.	.	.	.	.	.	.
Eragrostis superba	.	.	2b	.	.	.	.	.	.	.	.	.
Pseudognaphalium luteo-album	.	.	2a	2a	.	.	.	.	.	.	.	.
Diospyros mespiliformis	.	.	.	2b	.	.	.	.	.	.	.	.
Gerbera ambigua	.	.	2a	.	.	.	.	.	.	.	.	.
Species Group D												
Tristachya leucothrix	3	.	2a	3	.	.	.	.	.	.	.	.
Monocymbium ceresiiforme	2b	.	.	3	.	.	.	.	.	.	.	.
Species Group E												
Schoenoplectus corymbosus	.	.	.	.	.	2a	.	.	.	.	.	.
Sebaea grandis	.	.	.	.	.	2b	.	.	.	.	.	.
Aloe arborescens	.	.	.	.	.	2a	.	.	.	.	.	.
Hypoxis hemerocallidea	.	.	.	.	.	r	.	.	.	.	.	.
Pinus patula	.	.	.	.	.	1	.	.	.	.	.	.
Zea mays	.	.	.	.	.	3	.	.	.	.	.	.
Heteropogon contortus	.	.	.	.	2a	2b	.	.	.	.	.	.
Species Group F												
Verbena officinalis	.	.	.	.	2a	.	.	.	.	.	.	.
Stoebe vulgaris	.	.	.	2a	.	2b	.	.	.	.	.	.
Eragrostis gummiflua	.	.	2b	.	2a	.	.	.	.	.	.	.
Eragrostis racemosa	.	2b	2b	.	.	.	.	2b	.	.	.	.
Themeda triandra	3	.	4	3	3	3	.	.	.	.	.	.
Species Group G												
Cynodon dactylon	.	.	.	.	.	.	.	.	3	.	.	.

Survey Plots	12	10	6	11	2	1	4	3	5	7	8	9
Chamaesyce inaequilatera	.	.	.	.	.	.	2b	.	.	.	.	.
Pennisetum clandestinum	.	.	.	.	.	.	4	3	.	.	.	.
Species Group H												
Sutherlandia frutescens	.	.	.	.	.	.	.	.	.	2b	.	.
Enneapogon cenchroides	.	.	.	.	.	.	.	.	.	2b	.	.
Lippia javanica	.	.	.	.	.	.	.	.	.	r	.	.
Gomphocarpus fruticosus	.	.	.	.	2a	.	.	.	.	2a	.	.
Andropogon appendiculatus	.	.	.	.	.	2b	.	.	.	3	.	.
Species Group I												
Helichrysum aureonitens	.	.	.	2a	2b	2b	.	2b	.	2b	.	.
Aristida congesta s. congesta	.	2b	.	.	.	2b	2a	2b	.	2b	.	.
Acacia mearnsii	3	.	.	.	.	1	.	.	.	2a	.	.
Species Group J												
Gladiolus dalenii	.	.	.	.	.	.	.	.	.	.	2b	.
Hibiscus trionum	.	.	.	.	2b	.	.	.	2a	.	r	.
Andropogon eucomus	.	.	.	.	.	2b	.	2a	2b	.	2b	.
Helichrysum acutatum	.	.	2b	.	.	3	.	.	3	.	2b	.
Cortaderia selloana	.	3	.	.	.	.	.	.	.	1	2b	.
Species Group K												
Cirsium vulgare	3	2b	.	.	.	.	.	.	2b	2a	2b	.
Hypochaeris radicata	2b	.	2a	3	2b	2b	3	2a	2a	2a	2b	.
Species Group L												
Amaranthus hybridus	.	.	.	.	.	.	.	.	.	.	.	2b
Digitaria eriantha	.	4	.	.	.	.	.	.	.	.	.	3
Brachiaria brizantha	.	.	.	.	.	.	.	.	.	.	.	2a
Datura stramonium	.	.	.	.	.	.	.	.	.	.	.	2b
Species Group M												
Setaria sphacelata v. sphacelata	.	.	.	.	2b	3	.	.	2a	3	.	3
Hyparrhenia hirta	.	.	2a	3	3	3	3	2a	3	.	2a	4
Conyza bonariensis	.	2b	.	.	.	2b	3	.	3	3	3	3
Species Group O												
Paspalum dilatatum	.	2b	2a	.	.	.	.	.	.	2b	3	2b
Oxalis obliquifolia	.	3	3	.	3	2a	.	2a	2b	.	r	2a
Cyperus longus	.	2b	2a	.	.	2a	.	2a	2a	2a	3	2a
Bidens pilosa	3	.	.	.	2b	2a	2a	.	.	.	.	2b
Sporobolus africanus	2b	.	.	2b	2b	4	2a	2b	2b	.	2b	2a
Sporobolus pyramidalis	2b	.	.	3	.	.	.	2a	.	.	2b	2b

Survey Plots	12	10	6	11	2	1	4	3	5	7	8	9
Panicum maximum	2b	.	2b	2b	2a	2b	2b	2a	3	2a	2b	2b
Verbena bonariensis	3	3	2a	2b	3	3	3	3	4	2b	2b	2a

Tristachya leucothrix- Monocymbium ceresiiforme grassland

This grassland communitiy is found in disturbed and overgrazed areas. The presence of alien invasive species such as *Bidens bipinnata* (Commom Black-jack), which is a widespread weed (Pooley 1998), is an indication of disturbed areas. The diagnostic species are in Species Group D. This community has two sub-communities, namely *Bidens bipinnatus-Melinis nerviglumis* sub-community and *Berkheya setifera-Diospyros mespiliformis* sub-community.

The prominent species in grass layer are Melinis nerviglumis (Species Group A), Typha capensis Bothriochloa radicans (Species Group B), Eragrostis superba (Species Group C), Eragrostis gummiflua, Eragrostis racemosa, Themeda triandra (Species Group F), Aristida congesta s. congesta(Species Group I) and exotic grass Cortaderia selloana(Species Group J).

The herbaceous layer is dominated by *Bidens bipinnata* (Species Group A), reed *Cyperus esculentus* (Species Group B), *Berkheya setifera* (Species Group C) and *Cirsium vulgare* (Species Group K).

The tree or shrub layer is characterized by *Diospyros mespiliformis* (Species Group C) and *Acacia mearnsii* (Species Group I).

Bidens bipinnatus-Melinis nerviglumis sub-community

This sub-community is characterized by Species Group A. The diagnostic species are *Bidens bipinnatus* and *Melinis nerviglumis.*

The prominent species in the grass layer are Bothriochloa radicans (Species Group B), Tristachya leucothrix, Monocymbium ceresiiforme (Species Group D), Themeda triandra (Species Group F), Sporobolus africanus, Sporobolus pyramidalis and Panicum maximum (Species Group O).

The herbaceous layer is dominated by *Cirsium vulgare, Hypochaeris radicata* (Species Group K), *Bidens pilosa* and *Verbena bonariensis* (Species Group O).

Tree or shrub layer is characterized by *Acacia mearnsii* (Species Group I).

Berkheya setifera-Diospyros mespiliformis sub-community

The prominent species in the grass layer are Typha capensis, Bothriochloa radicans (Species Group B), Tristachya leucothrix, Monocymbium ceresiiforme (Species Group D), Eragrostis racemosa, Themeda triandra (Species Group F), Aristida congesta s. congesta(Species Group I), Cortaderia selloana(Species Group J), Digitaria eriantha(Species Group L), Hyparrhenia hirta(Species Group M), Paspalum dilatatum, Sporobolus pyramidalis and Panicum maximum (Species Group O).

The herbaceous layer is dominated by Cyperus esculentus (Species Group B), Helichrysum acutatum (Species Group J), Cirsium vulgare, Hypochaeris radicata (Species Group K), Conyza bonariensis (Species Group M), Oxalis obliquifolia, Cyperus longus and Verbena bonariensis (Species Group O).

No tree or shrub layer is present in this sub-community.

Setaria sphacelata v. sphacelata- Hyparrhenia hirta grassland

This communitiy is found in tall grassland and it is not highly disturbed and undergrazed. It is charaterized by Species Group M. The diagnostic species are *Hyparrhenia hirta, Setaria sphacelata v. sphacelata* and *Conyza bonariensis*. This community has two sub-communities, namely *Amaranthus hybridus-Datura stramonium* sub-community and *Helichrysum aureonitens-Aristida congesta s. congesta* sub-community.

The prominent species in the grass layer are Heteropogon contortus (Species Group E), Eragrostis gummiflua Themeda triandra (Species Group F), Pennisetum clandestinum (Species Group G), Andropogon appendiculatus (Species Group H), Aristida congesta s. congesta (Species Group I), Andropogon eucomus(Species Group J), Digitaria eriantha (Species Group L), Paspalum dilatatum, Sporobolus africanus, Sporobolus pyramidalis and Panicum maximum (Species Group O).

The herbaceous layer is dominated by Stoebe vulgaris (Species Group F), Gomphocarpus fruticosus (Species Group H), Helichrysum aureonitens (Species Group I), Hibiscus trionum, Helichrysum acutatum (Species Group J), Cirsium vulgare, Hypochaeris radicata (Species Group K), Oxalis obliquifolia, Cyperus longus, Bidens pilosa and Verbena bonariensis (Species Group O).

Tree or shrub layer is characterized by *Acacia mearnsii* (Species Group I).

Amaranthus hybridus-Datura stramonium sub-community

This sub-community is characterized by Species Group L. The diagnostic species in the grass layer are *Digitaria eriantha* and *Brachiaria brizantha*, while the diagnostic species in herbaceous layer are alien invasive species *Amaranthus hybridus* and *Datura stramonium.*

The prominent species in the grass layer are Andropogon eucomus, Cortaderia selloana (Species Group J), Setaria sphacelata v. sphacelata, Hyparrhenia hirta (Species Group M), Paspalum dilatatum, Sporobolus africanus, Sporobolus pyramidalis and Panicum maximum (Species Group O).

The herbaceous layer is dominated by Gladiolus dalenii, Helichrysum acutatum (Species Group J), Cirsium vulgare, Hypochaeris radicata (Species Group K), Conyza bonariensis (Species Group M), Oxalis obliquifolia, Cyperus longus, Bidens pilosa and Verbena bonariensis (Species Group O).

No tree or shrub layer is present in this sub-community.

Helichrysum aureonitens-Aristida congesta s. congesta sub-community

This sub-community is characterized by Species Group I. The diagnostic species are *Helichrysum aureonitens, Aristida congesta s. congesta* and *Acacia mearnsii*.

The prominent species in the grass layer are Heteropogon contortus (Species Group E), Eragrostis racemosa, Themeda triandra (Species Group F), Cynodon dactylon, Pennisetum clandestinum (Species Group G), Andropogon appendiculatus (Species Group H), Andropogon eucomus (Species Group J), Setaria sphacelata v. sphacelata and Hyparrhenia hirta(Species Group M).

The herbaceous layer is dominated by Sebaea grandis, Zea mays (Species Group E), Stoebe vulgaris(Species Group F), Sutherlandia frutescens, Enneapogon cenchroides(Species Group H), Hibiscus trionum, Helichrysum acutatum (Species Group J), Cirsium vulgare, Hypochaeris radicata (Species Group K) and Conyza bonariensis(Species Group M).

Tree or shrub layer is characterized by *Pinus patula* (Species Group E).

Invasive and exotic species recorded

A total of 11 alien invasive species were observed during the dry season survey and 15 species were observed during the wet season. Alien invasive species tend to out compete the indigenous vegetation and this is due to the fact that they usually are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 1995). They are tough, can withstand unfavourable conditions and are easily spread. This is indicative of early stages of succession and although these species are invasive they do aid in the prevention of erosion. Tree species like Pinus patula (Figure 24) and Acacia mearnsii dominate the bottom valleys of the site (Figure 25) whereas species such as Datura stramonium (Figure 26 are found in the maize field areas.

Figure 24: Exotic Pinus patula next to the pan

Figure 25: Acacia mearnsii dominate the bottom valleys next to the pans

Plan 15: Plant community for Weltevreden

Figure 26: Datura stramonium growing next to the maze fields

Cultural and medicinal plant species

During the dry season, 14 medicinal plants were observed and same amount were observed during the wet season. *Boophane disticha* (Fan-leaved Boophane) is used in traditional medicine to treat pain, wounds and as a narcotic and *Pseudognaphalium luteo-album* (Jersey Cudweed) is traditionally used to fumigate a room where a child is feverish and to make a 'mattress' on which skins are cured (Pooley 1998).

Red data plant species

No Red Data plant species were recorded during both surveys.

2.1.1.13 Animal life

Mammals observed and recorded in the area

Actual sightings, spoor, calls, dung and nesting sites were used to establish the presence of animals on the proposed project site. The evidence of dung and spoor suggests that these animals were in the area even though very few were observed during the surveys. Traps were also placed in front of fresh burrows in an attempt to identify smaller animals in the area. Table 33 and Table 34 list all animals observed during both dry and wet season surveys respectively.

Table 33: Mammals observed at the site during the dry season

Order:	Family:	Genus	Species	English name	Status
Artiodactyla	*Bovidae*	*Sylvicapra*	*grimmia*	Common duiker	Least concern
Hyracoidea	*Procavidae*	*Procavia*	*capensis*	Rock dassie	Least concern
Rodentia	*Pedetidae*	*Pedetes*	*capensis*	Springhare	Least concern
Rodentia		*Unknown*			

Table 34: Mammals observed at the site during the wet season

Order:	Family:	Genus	Species	English name	Status
Carnivora	Herpestidae	Ichneumia	albicauda	White-tailed Mongoose	Least concern
Artiodactyla	Bovidae	Sylvicapra	grimmia	Grey /Common Duiker	Least concern

No Red Data mammals were observed

Reptiles

Only one lizard was observed during the dry season survey on Zoekop farm but could not be identified.

Frogs

Table 35 below indicates three frogs' species that have been recorded in the Weltevreden study area during the wet season survey. No Red Data frog was recorded during the sampling survey.

Table 35: The expected frog species to occur within the study area

Common name	Family name	Genus	Species
Common Platana	Pipidae	Xenopus	laevis
Common River Frog	Ranidae	Afrana	angolensis
Tremola Sand Frog	Ranidae	Tomoptema	cryptotis

Insects

The area is highly disturbed with most parts covered with maize fields. The vegetation is characteristic of the grassland biome, with herbs and grasses making up the major plant groups. Some invasive trees also occur in the area. It would be expected that with the vegetation type of the area one would find members of the Orthoptera (grasshoppers, locusts and crickets), Hemiptera (bugs, cicadas, and leaf hoppers), Lepidoptera (butterflies and moths), Coleoptera (beetles), Hymenoptera (wasps and ants) and flies (Diptera) (Picker, et al., 2002). The Chironomidae family had the highest species richness (Table 36) and Reduviidae family had the highest species richness during the wet season (Table 37).

Table 36: Total number of families found in Weltevreden during the dry season

Family	Total Abundance	Family	Total Abundance
Acanthosomatidae	1	Issidae	2
Acrididae	10	Lygaeidae	5
Anthicidae	2	Mantidae	2
Apionidae	6	Meloidae	2
Aradidae	1	Muscidae	16
Asilidae	29	Pentatomidae	2
Calliphoridae	7	Pompilidae	2
Cerambycidae	1	Reduviidae	4
Ceratopogonidae	5	Sepsidae	8
Chironomidae	172	Sphecidae	12
Chrysomelidae	8	Staphylinidae	1
Cicadellidae	42	Syrphidae	7
Cixiidae	10	Tabanidae	2
Coccinellidae	11	Tachinidae	3
Coreidae	6	Tachnidae	1
Culicidae	4	Tenebrionidae	1
Cydnidae	1	Tenthredinidae	8
Dolichopodidae	9	Tephritidae	8

Table 37: Total number of families found during the wet season

Different Families	Total Abundance	Different Families	Total Abundance
Acrididae	12	Formicidae	14
Alydidae	4	Languriidae	1
Aradidae	4	Mantidae	4
Asilidae	4	Meloidae	17
Carabidae	2	Muscidae	47
Cercopidae	1	Pentatomidae	4
Chironomidae	17	Pompilidae	1
Chrysomelidae	20	Reduviidae	151
Cicadellidae	4	Scarabaeidae	5
Coccinellidae	6	Sepsidae	8
Coenagrionidae	7	Sphecidae	2
Curculionidae	43	Staphylinidae	4
Dictyopharidae	4	Tenebrionidae	18
Elateridae	1	Tipulidae	16

2.1.1.14 *Avifauna*

The Avifauna Report is attached in Appendix P

Micro habitats and associated avifauna

Although much of the distribution and location of bird species within the study area can be explained by vegetation as discussed briefly above, it is necessary to look more closely at the smaller habitat niches available to birds, namely the microhabitats, in order to determine where the relevant species will most likely occur within the study area. These microhabitats do not always correspond to vegetation types and are determined by a combination of vegetation type, topography, land use, food sources and other factors.

The following distinct bird microhabitats were identified in the study area during the field visit in March 2010 (see APPENDIX A for examples of the microhabitats):

Wetlands and dams:

This habitat is represented in the study area by several man-made impoundments (dams), as well as a few drainage lines and some wetland area. The wetlands are impacted upon by agricultural fields that borders in many instances almost right on the water's edge – leaving little room for edge vegetation and moist submerged grassland. Amongst large terrestrial birds it is especially the three cranes species that depend on shallow, vegetated wetlands that are unpolluted and not excessively disturbed by live-stock and fire.

The data from the Co-ordinated Road Count project (CAR) of the Avian Demography Unit shows that the wetlands in the Mpumalanga highveld are extensively used by Spurwing Goose Plectropterus gambensis, Black-headed Heron Ardea melanocephala and Grey Crowned Crane Balearica regulorum. Grey Crowned Cranes and Blue Cranes Anthropoides paradiseus were recorded in the 2530CC Quarter degree grid cell (Harrison et al. 1997) see Table 38 below. It is however very unlikely that they occur in the study area itself.

The small size and fragmented nature of the wetlands reduces the suitability of the habitat on the site for cranes, and they are therefore not likely to frequent the dams and drainage lines in the study area. This is not only because of marginal habitat and the degradation thereof, but also because of disturbance (especially agricultural activities) and the proliferation of power lines which may have taken their toll on birds over the years. The previous statement is admittedly speculative, but the sensitivity of cranes to human activity has been proven (Morrison 1998), as well as their vulnerability to power line collisions (Van Rooyen 2006).

Discussions with Ms Ursula Franke from the Endangered Wildlife Trust's (EWT) Highveld Grasslands Crane Conservation Project revealed that a pair of Grey Crowned Cranes is known to frequent the Blyvooruitzicht farms to the immediate South West of the study area. Ms. Franke also indicated that although Blue Cranes occur in greater numbers further south and east they are not known to frequent the study area or immediate surrounding grasslands and wetlands.

According to Mr. Koos Pretorius, one of the landowners, Blue Cranes have been observed on the wetlands in the area but as mentioned before the fragmented nature of suitable habitat reduces the likelihood that they will regularly occur in the area. It is unlikely that the dams and associated wetlands on the site would provide suitable habitat for any of the Red Data species recorded in the area.

Non-threatened species that may from time to time occur on the wetlands, especially in quiet secluded areas of the dams in the study area, include Little Bittern Ixobrychus minutus, Black Crake Amaurornis flavirostris, Common Moorhen Gallinula chloropus, Green-backed Heron Butorides striata, African Snipe Gallinago nigripennis and various kingfishers (Marais & Peacock 2008). Open water may attract grebes, cormorants, darters and various species of ducks, as swell as Red-knobbed Coot Fulica cristata. Areas with reeds, sedges or grassy tangles are suitable for Common Waxbills Estrilda astrild and various warblers (Marais & Peacock 2008). The larger dam in the study site towards the north western corner has the best habitat for the above mentioned species

Agriculture:

The majority of the study site has been extensively transformed through dryland cultivation of maize and potatoes. The farm land in the area is used for a variety of mixed farming practices. Grazing is developed in parallel with crop farming. The Mpumalanga highveld has summer rainfall; therefore intensive crop farming is practiced on a wide scale. Some of the maize lands are bordered by tracts of grassland ideal for grazing. Extensive areas stand under stubble during the winter and provide alternative grazing (Young et al. 2003).

Data from the CAR project indicates that agricultural land is used to a limited extent by large terrestrial birds in the Mpumalanga highveld, as they prefer natural grassland. Fallow fields are used to a limited extent by Blue Cranes in summer, and pastures are used by Southern Bald Ibis Geronticus calvus. Blue Cranes also use recently ploughed fields in winter (Young et.al. 2003). However, as mentioned earlier, the chances of Blue Cranes regularly occurring in the study area are very slim. Indications are that Blue Korhaan Eupodotis caerulescens may also utilise agricultural fields to a limited extent (Young et al 2003).

Southern Bald Ibis are likely to occur on the site as they are known to forage in reaped maize fields and ploughed lands (Harrison et al 1997). Although not regarded as a threatened species, numerous Amur Falcons Falco amurensis were observed foraging over the cultivated fields and grasslands. Overall though, agricultural lands are not as important for birds in the study area as natural grassland

Natural grassland:

A few areas of untransformed natural grassland have remained in the study area, as well as some small areas of abandoned lands that have reverted back to grassland. The CAR data indicate that natural grassland remains the preferred habitat of large terrestrial birds in the Mpumalanga highveld (Young et al. 2003). As indicated above (see 2.2. Wetlands and dams) large terrestrial grassland species such as the Blue Crane are not likely to occur on the grasslands on the study site. This is also supported by the CAR data which revealed that no Blue Cranes were reported along the R33 Belfast – Carolina MS09 route while low numbers of Grey Crowned Cranes were reported.

The low reporting rates and absence of these species could be the result of the extensive fragmentation of natural grassland by agriculture, open cast mining, regular burning, disturbance, the impact of agro-chemicals and particularly power lines and roads. Be as it may, several typical Red Data grassland species were recorded in the square by SABAP1, including Southern Bald Ibis Geronticus calvus, White-bellied Korhaan Eupodotis senegalensis, Blue Korhaan Eupodotis caerulescens, Secretarybird Sagittarius serpentarius, Lesser Kestrel Falco naumanni and Denham's Bustard Neotis denhami. The Bald Ibis also forages preferentially on recently burnt ground but also exploits unburnt natural, cultivated pastures (Harrison et al 1997). SABAP1 and 2 both report fairly regular (both above 10%) reporting rates for White-bellied and Blue Korhaans. It is therefore likely that these species could occur in the pockets of grassland remaining on the site.

Ms Franke from the EWT indicated that Secretarybirds are regularly reported in the area where the study site is located. The Denham's Bustard occurs during the breeding season (September to March) in high rainfall sour grassland (Harrison et al 1997). However, the small sizes of the fragments of grassland left on the study site and the levels of potential disturbance makes it unlikely that the bustards will occur there. Lesser Kestrels are Palearctic migrants present in summer from November through March. They prefer to forage over semi-arid grasslands and agricultural fields – however the low report rate for the species is indicative of sub-optimal habitat; it is therefore unlikely that the Lesser Kestrel will occur on the study site. A Red Data species that could also occur in this habitat from time to time is the Black-winged Lapwing Vanellus melanopterus – they prefer short burnt or cropped grassland.

Non-threatened species that may from time to time frequent the grassland habitat in the study area are Swainson's Spurfowl Pternistis swainsonii, African Pipit Anthus cinnamomeus, Cape Longclaw Macronyx capensis, several cisticola species, Long-tailed Widowbird Euplectes progne, Rufous-naped Lark Mirafra africana, and Black-shouldered Kite Elanus caeruleus (Harrison et al 1997).

Red data species

Generally speaking, it is unavoidable that birds get displaced by industrial development, including mining operations, despite the best possible mitigation measures. It is therefore important to direct risk assessments and mitigation efforts towards species that have a high biological significance, in order to achieve maximum results with the available resources at hand.

In accordance with this principle, the risk assessment is primarily aimed at assessing the potential threat to Red Data species. It is important to note though, that any proposed measures aimed at mitigation impacts on Red Data species will also benefit the non-threatened species.

The Red Data bird species that were recorded by SABAP1 in the relevant quarter degree square is listed in Table 38 below. The squares were quite well surveyed during the SABAP1 period with 75 checklists completed for 2530CC. The total number of SABAP2 checklists that have been completed for 2530CC are 19. The number in the reporting rate column in Table 38 below represents the percentage of cards on which a species was recorded. Table 38 also provides an indication of whether a species is likely to occur on the site.

Table 38: Red Data species recorded in 2530CC by SABAP1 and SABAP2

Species	**Conservation status (Barnes 2000)**	**SABAP1 Reporting rate % 2530CC**	**SABAP2 Reporting rate % 2530CC**	**Habitat requirements (Barnes 2000; Hockey *et al* 2005; Harrison *et al* 1997; Young *et al* 2003; personal observations)**
SOUTHERN BALDIBIS *Geronticus calvus*	Vulnerable	29.3	47.4	High altitude grassland, also agricultural fields. Often in recently burnt veld. Likely to occur on the study area from time to time when suitable habitat exists either in the grasslands or cultivated fields.
WHITE-BELLIED KORHAAN *Eupodotis senegalensis*	Vulnerable	17.3	31.6	Often in the interface between grassland and savanna. Avoids severely grazed and recently burnt sites. Could potentially be present in patches of tall grass.
SECRETARYBIRD *Sagittarius serpentarius*	Near threatened	21.3	26.3	Prefer open grassland, densities lower in maize growing areas. Occasional presence confirmed by EWT and landowner.
BLUE CRANE *Anthropoides paradiseus*	Vulnerable	24.0	21.1	Short grassland, pastures, stubble lands and wetlands. Unlikely to occur in the study area due to largely unsuitable fragmented habitat, extensive disturbance, and habitat transformation.
BLUE KORHAAN *Eupodotis caerulescens*	Near threatened	10.7	10.5	Grasslands, pastures and cultivated fields. Could potentially be present on the study site.
CAPE VULTURE *Gyps coprotheres*	Vulnerable	-	21.1	Mountainous areas – inselbergs and escarpments; forages over surrounding open country. Unlikely to occur in the study area.
BUSH BLACKCAP	Near threatened	-	15.8	Thickets fringing montane forest in narrow ravines. Unlikely

Species	Conservation status (Barnes 2000)	SABAP1 Reporting rate % 2530CC	SABAP2 Reporting rate % 2530CC	Habitat requirements (Barnes 2000; Hockey *et al* 2005; Harrison *et al* 1997; Young *et al* 2003; personal observations)
Lioptilus nigricapillus				to occur in the study area ~ no suitable habitat.
LANNER FALCON *Falco biarmicus*	Near threatened	1.3	10.5	Occurs in a wide range of habitats. Unlikely to occur regularly on the study site but could pass through from time to time.
BLACK-WINGED LAPWING *Vanellus melanopterus*	Near threatened	2.7	5.3	Prefers high altitude short or burnt grasslands. Due to the limited amount of suitable habitat on the study site it is unlikely to occur there. Could sporadically appear in the area shortly after veld fires.

Classification of bird habitat

One of the aims of this impact study is to classify the bird habitat in the whole of the study area in various classes of sensitivity. For these purposes, a simple three-tier classification system was used. The criteria for classifying the habitat were primarily the likelihood of Red Data species using a specific class of habitat. Table 39 below describes the different sensitivity classes, as well as the potential use by Red Data species in the study area.

Table 39: Habitat sensitivity classes

Rating	Description	Potential Red Data species in study area
Least sensitivity	Exotic tree stands Agricultural lands Highly transformed grassland and wetlands, and degraded old lands	Lesser Kestrel Southern Bald Ibis Blue Korhaan
Medium sensitivity	Moderately transformed grass-land and wetlands	Lesser Kestrel White-bellied Korhaan Southern Bald Ibis Secretarybird Blue Korhaan Black-winged Lapwing
Higher sensitivity	Least transformed wetlands, natural pans and dams	Grey Crowned Crane Denham's Bustard

The following conclusions can be drawn from this investigation:

- The natural habitat in the study area has for decades been subjected to significant impacts, particularly habitat transformation through agricultural activity, grazing pressure in and regular burning of grasslands and wetlands, which has lead to high levels of fragmentation and degradation. This makes the regular occurrence of Red Data species such as Blue Crane and Grey Crowned Crane unlikely;
- Undisturbed, relatively pristine grassland and wetland habitat does exist to the south and east of the study area. These areas support Red Data avifauna and the cumulative impact of proposed mining operations in the area, if allowed to

continue, could potentially have significant negative consequences for these species; and

- Despite the significant impacts already evident in the study area, potentially medium to higher sensitive areas remain which certain Red Data species could occasionally use for foraging. These sensitive areas are in particular some of the wetland habitat and grassland areas. Red Data species that could occur from time include Secretarybird, Southern Bald Ibis, White-bellied Korhaan, Blue Korhaan, Black-winged Lapwing, and Grey Crowned Crane.

Plan 16: Avian sensitivity plan

2.1.1.15 Sites of archaeological and cultural interest

The Northern Coal Weltevreden Project in located within the Witbank coal field 25km south of Belfast in the Mpumalanga Province. The regional area of Belfast was relatively active with combats, railway sabotages and battles during the Anglo Boer War (1899-1902) in the Mpumalanga Highveld area. The Anglo-Boer War (or South African War) was waged between Great Britain and the two Boer Republics, the ZAR and the Oranje Vrystaat, from 1899 to 1902. The National Heritage Resources Act, Act No. 25 of 1999 deals with and offers protection to all historic and pre-historic cultural remains, including graves and human remains.

PGS Heritage Unit (PGS) conducted an Archaeological Impact Assessment (AIA) for the proposed Northern Coal Weltevreden Project Portions 15 and 16 of the farm Weltevreden 381 JT to identify and document any sites of archaeological or heritage significance in the proposed project area in July 2008. During the archaeological field assessment, no evidence of cultural remains or archaeological resources was found on site. The complete AIA Report can be found in Appendix K. It was documented that the study area is currently utilised for grazing and planting, and large sections of the area is covered by maize. Due to the fact that the AIA (2008) yielded no evidence of archaeological or heritage sites of significance in the proposed project area, South African Heritage Resource Agency (SAHRA) Archaeological, Palaeontological and Meteorite Unit has no objection to the Proposed Northern Coal Weltevreden Project to proceed, conditional to the notification of SAHRA/an archaeologist if any additional evidence of archaeological sites or artefacts, paleontological fossils, graves or other heritage resources are found during construction, operation or decommissioning.

2.1.1.16 Wetland areas

A wetland delineation and assessment was carried out on portion 15 and 16 of the farm Weltevreden 381 JT. The complete Wetland delineation and Assessment Report is attached in Appendix L.

Wetland delineation

The wetlands in the study area are linked to both perched groundwater and surface water. Five Hydro-geomorphic (HGM) types of natural wetland systems occur within the area assessed. These are:

- Valley bottom wetlands without channels.
- Hillslope seepage wetlands connected to watercourses;
- Hillslope seepage wetlands connected to pans;
- Isolated hillslope seepage wetlands; and
- Pans;

The various HGM types of wetland occurring in the study area are presented in Plan 21 The area (ha) of the different wetland types assessed and the percentage in relation to the study area is presented in Table 40.

Table 40 : Area of the different HGM wetland types within the study area.

	Area of wetland assessed within study area	
Wetland type	**Hectares (ha)**	**Percentage (%)**
Valley bottom without channels	41.5	25.9
Hillslope seepage wetlands connected to watercourses	65.7	41.0
Hillslope seepage wetlands connected to pans	2.9	1.8
Isolated hisllslope seepage wetlands	48.8	30.4
Pans	1.4	0.9
Total	160.3	100.0

Dams occupy 5.44ha of the study area and cover approximately 4% of the study area. Dams form the main artificial wetland type within the study area. The hillslope seepage wetlands connected to a watercourse occupy the greatest area, 65.7ha and cover approximately 41% of total study area. The valley bottom wetlands without a channel and isolated hillslope seepage wetlands occupy similar size areas, namely 41.5ha and 48.8ha respectively. Each of these wetland types covers approximately 30% of the study area. A single pan is present within the study area and occupies 1.4 ha and the associated hillslope seepage wetland connected to the pan occupies an area of 2.9ha. Approximately 30% of the study area is occupied by wetlands. Plan 17 illustrates the location of the identified wetlands.

Wetland functional assessment

The general features of the wetlands were assessed in terms of functioning and the overall importance of each hydrogeomorphic unit that was then determined at a landscape level. The level of functioning supplied by each of the hydrogeomorphic units for various ecological services is presented in Table 41. The results from the "WET-EcoServices" tool which looks at ecological services provided by wetlands i.e. water quality enhancement, biodiversity maintenance, flood attenuation, tourism etc and then a score is awarded for the importance of this service are presented below in Figure 27 to Figure 31.

Plan 17: Wetland delineation

Table 41: A listing and scoring of ecological services offered by each of the hydrogeomorphic units

Summary Sheet	Valley bottom wetland without a channel	Hillslope seepage wetland connected to a pan	Hillslope seepage wetland connected to a watercourse	Isolated hillslope seepage wetland	Pans
	Overall Score	Overall Score	Overall Score	Overall Score	Overall Score
Flood attenuation	2.3	1.9	2.2	1.8	1.8
Streamflow regulation	3.2	2.2	2.4	1.4	2.0
Sediment trapping	2.5	1.9	3.1	2.5	1.9
Phospahte trapping	3.2	1.9	3.0	2.6	1.9
Nitrate removal	3.3	2.6	2.8	2.5	2.6
Toxicant removal	3.2	2.3	3.1	2.8	2.3
Erosion control	2.0	1.8	2.5	2.2	0.8
Carbon storage	2.0	1.7	2.3	2.0	1.3
Maintenance of biodiversity	2.3	2.4	1.7	1.6	2.7
Water supply for human use	2.7	1.4	1.2	0.9	2.0
Natural resources	1.2	0.8	0.8	0.8	1.0
Cultivated foods	0.2	0.8	0.8	0.8	0.2
Cultural significance	0.0	0.0	0.0	0.0	0.0
Tourism and recreation	1.3	0.6	0.7	0.9	1.1
Education and research	1.8	1.8	1.3	1.0	1.8

Note: The ecoservices supplied by the wetland systems are scored according to the following:

0 – Low; 1 - Moderately Low; 2 – Intermediate; 3 - Moderately High; 4 - High

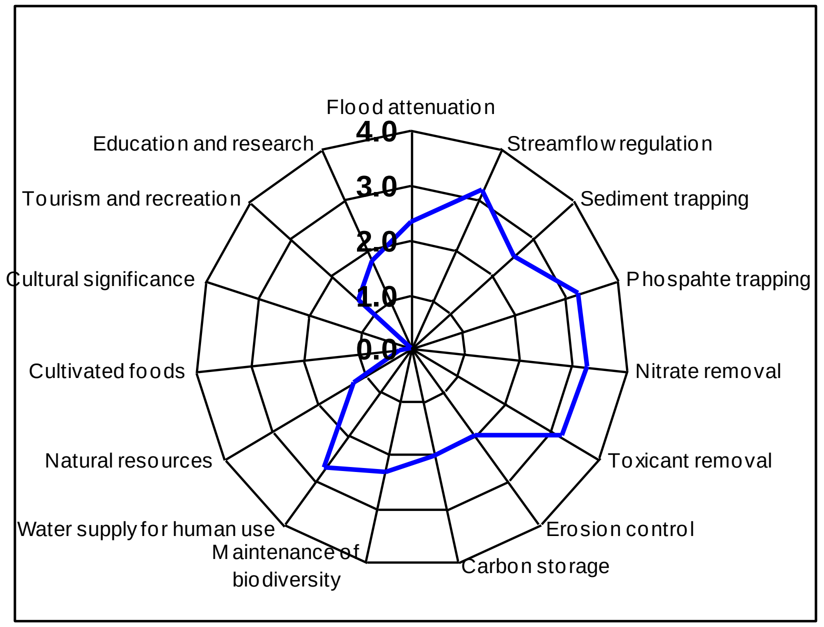


Figure 27: WET-EcoServices diagram for hillslope seepage wetlands

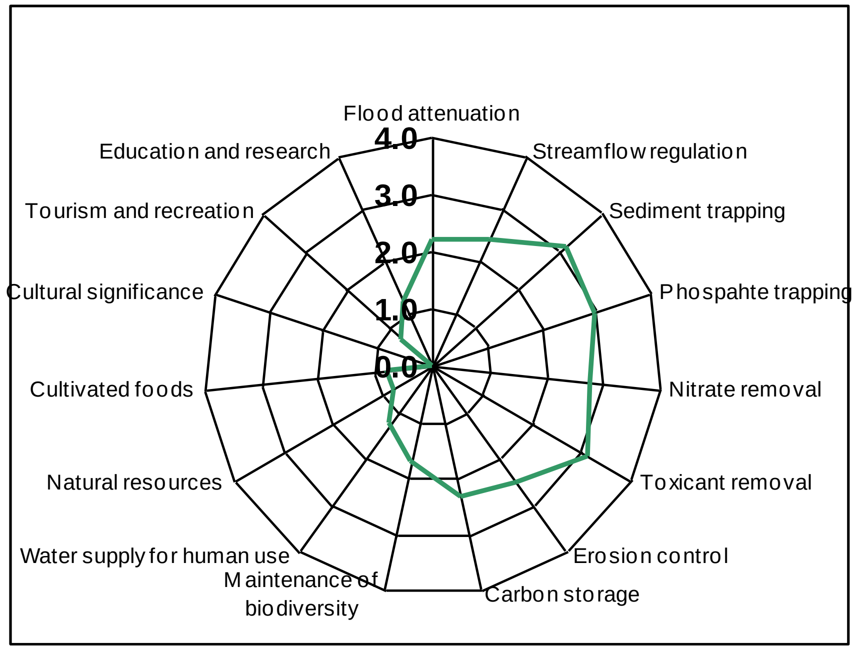


Figure 29: WET-EcoServices diagram for valley bottom wetlands without a channel connected to a watercourse

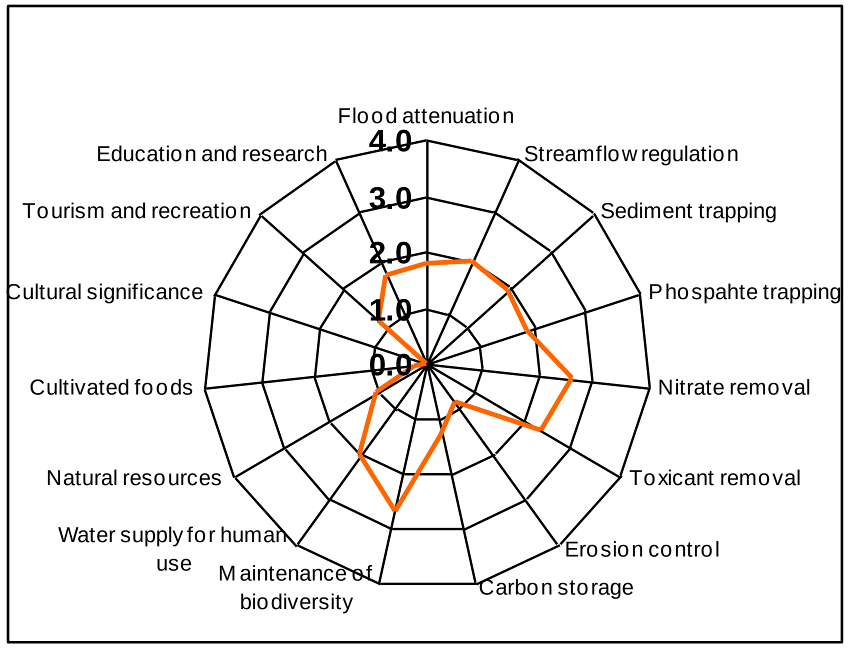


Figure 31: WET-EcoServices diagram for pans

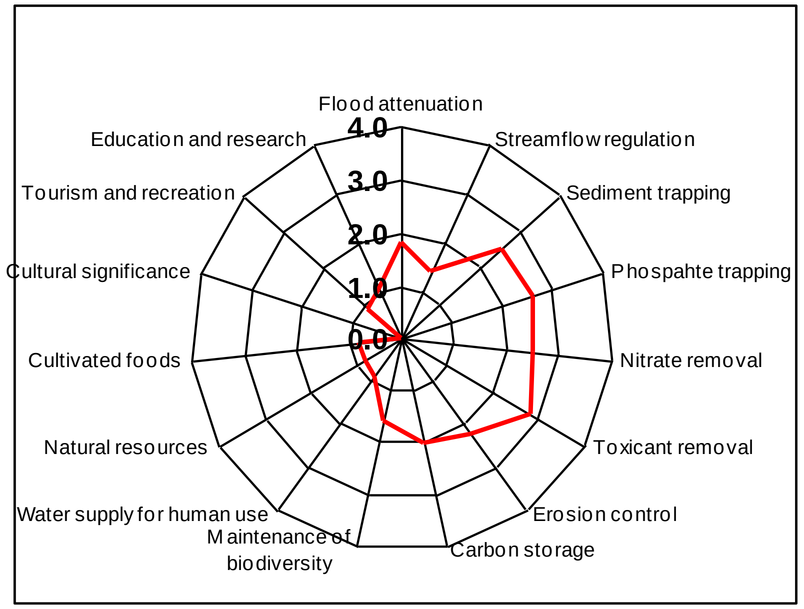


Figure 28: WET-EcoServices diagram for isolated hillslope seepage wetlands

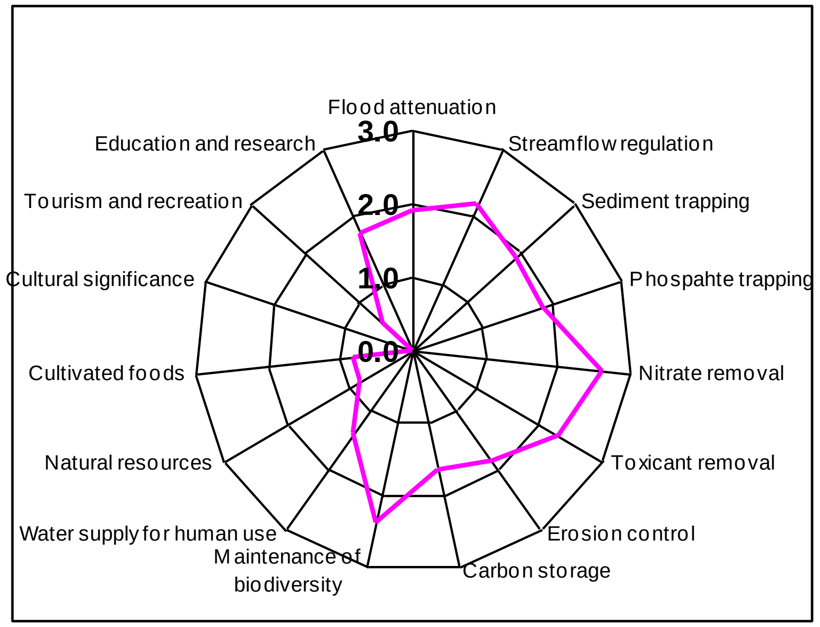
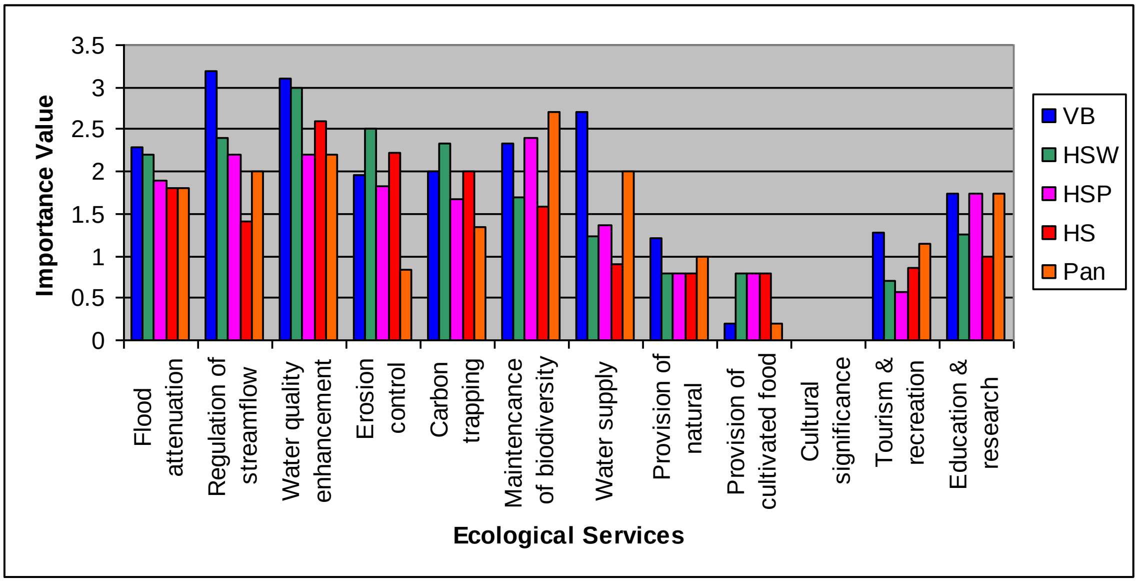


Figure 30: WET-EcoServices diagram for hillslope seepage wetlands connected to a pan

From the above information it can be seen that the hillslope seepage wetlands connected to the watercourse, isolated hillslope seepage wetlands and the valley bottom wetlands score moderately high for ecoservices which would be considered to be providing benefits and services in terms of water quality enhancement. These three wetland units provide ecological services such as sediment trapping, phosphate trapping as well as nitrate and toxicant removal. The pan and associated hillslope seepage wetland obtained intermediate scores for similar water quality enhancement ecoservices provided. This is a clear indication that most important function of these wetland areas is the contribution of these wetland units to improve water quality within the catchment. The importance of the various ecological services offered for each wetland unit is presented in Figure 32. It is important to consider the proximity of agricultural land to the wetlands, the use of the wetlands by game and livestock as well as by humans. Additionally, the proposed mining activities may limit the quantity of water recharging the wetland areas as well as impact on the quality of available water, thus it may be assumed that the functioning of the wetland areas to offer services in terms of water quality improvement would become more important as mining operations progressed.



***Note**: VB* – *Valley bottom wetland*

HSW – *Hillslope seepage wetland connected to a watercourse*

HSP – *Hillslope seepage wetland connected to a pan*

HS – *Isolated hillslope seepage wetland*

Pan – *Pan*

Figure 32: A summarised comparison of ecological services offer for each wetland unit and the importance of each service

As a result of the reduction in the quantity of water recharging wetland areas, it may be assumed that certain wetland areas will be lost. However, in spite of this it is imperative that the loss of wetland areas is minimal so as to maintain the ecological services offered by the wetlands. The valley bottom wetlands receive water inputs from adjacent slopes via runoff and interflow from hillslope seepage areas. Hillslope seepage areas receive water inputs from groundwater, perched aquifers and interflow. A result of the proposed opencast mining activities there will be alterations in underground water dynamics as well as the removal of surface drainage areas. This in turn will limit the quantity of water reporting to the wetland areas downstream. Pans receive water inputs from runoff from the surrounding catchment area and lateral seepage from adjacent hillslope seepage wetlands and water is discharged from the pans into groundwater system via leakages. The proposed mining area will remove the pan and the associated catchment, hillslope seepage areas as well as surface areas contributing to sub-surface flow through. As a result of this impact, it is strongly recommended that where possible wetland areas downstream of the mining operation are recharged artificially. Wetlands share a primary driving force, water. Areas in the landscape where water accumulates for long enough and often enough to influence plants, animals and soils provide ecological functioning. A loss of water to these wetlands will mean a loss of ecological services provided for.

Determining the Present Ecological Status (PES) of the wetlands

All of the wetlands within the study area have been modified to some extent with approximately 75% of the wetlands being moderately modified. Additionally, the remaining wetland areas have been largely modified. The percentage relating to the PES is as follows:

- 76.3% are moderately modified (with a PES of C); and
- 23.7% are largely modified (with a PES of D).

The present state of the majority of the wetlands in the study area is therefore modified to some extent when compared with what would be expected for reference conditions. Areas which have been moderately modified are largely the result of agricultural practices, particularly damming, cultivation and livestock farming. All of these practices may impact on the quality of available water as well as increase the sediment loads reporting to the wetland areas. Moderately modified wetland areas have some loss of natural habitat. Wetland areas which have been largely modified are a result of the construction of roads, crossings, agricultural fields and drainage channels to drain wetland areas. These wetland areas have a significant loss of natural habitat as well as a loss of basic ecosystem functioning.

Determining the Ecological Importance and Sensitivity (EISC) of the wetlands

The highest ecological importance and sensitivity scores (rated as C – moderate) are associated with approximately 60% of the wetlands within the study area. These have the highest EIS scores predominantly as a result of their functioning to retain water and support adjacent wetland areas through interflow seepage. These wetland areas are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetland areas are not usually sensitive to flow and habitat modifications and in addition to this, these wetland areas play a small role in moderating the quantity and quality of water of major rivers.

Approximately 40% of all the wetlands within the study area have been rated low to marginal (rated as D) and these areas are no longer ecologically important and sensitive at any scale. The reason being, these areas are currently being disturbed and functioning altered through agricultural practices as well as with the destruction of wetland areas by road and drainage channel construction. As a result of this no biodiversity could be identified to be dependent on these systems. Additionally, these wetland areas will now play an insignificant role in moderating the quantity and quality of water of major rivers.

A soil, land capability and land use assessment was conducted by Rehab Green CC and findings from the survey have been used to supplement the findings from the wetland assessment. According to Rehab Green CC the delineated wetland areas play a very important part in the ecosystem which is already largely disturbed by agricultural activities. The wetland areas function as surface drainage systems, an important habitat and a mechanism to recharge the ground water system as well as open water sources downstream. In conclusion four of the seasonal and permanent wetland zones which form part of drainage lines and are linked to open water sources need to be protected and were excluded from the proposed opencast area. These wetland zones should also be protected by means of a 50m buffer zone.

2.1.1.17 Visual aspects

The visual aesthetic of the area is characterised by a hilly topography, covered by agricultural activity and grasslands. The proposed mining activity will have an impact on the visual aesthetic of the immediate surrounds. In order to assess the extent of the intrusion of the proposed mining activity, Geographic Information System (GIS) technology is utilised. A Digital Terrain Model (DTM) was used in conjunction with the site plan to model the "viewshed" area. This can be seen in Plan 18. A viewshed area denotes the area which will have a direct line-of-sight with the proposed mining activity, or in other words: if you are standing within the viewshed area, there is a high probability that you may see the proposed mining activity. The viewshed for the proposed mining activities at Weltevreden equate to approximately 54km² and the site may be visible from several kilometres away, this is due to the high elevation of the site and it's location on a prominent ridge within the region. It must be noted that the site may also be visible from certain sections of the N4 and R33. Typically what can be expected to be seen is the temporary mining infrastructure and the open cast pits. The viewshed area has been linked with the cadastral information to extract which farm portions may be affected. The table below lists the farms concerned. Table 42 lists the farms and portion in which the proposed mining activity may be visible.

Table 42: Farm portions from where the proposed mining activity may be visible from.

Farm Name	Farm Portion
BERGENDAL 378 JT	3, 5, 7, 9, 16, 17
BLYVOORUITZICHT 383 JT	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18
EERSTELINGSFONTEIN 406 JT	1, 3, 5, 6, 7, 8, 9
GELUK 405 JT	1, 9, 10, 11, 12, 13, 14
KAALPLAATS 453 JS	1, 6
LEEUWBANK 427 JS	5, 6, 10, 12, 13, 15, 20, RE
PAARDEPLAATS 380 JT	15, 29, 33, 34, 36, 37, 38, 40, RE
PAARDEPLAATS 425 JS	1, 3, RE
RIETVALLEY 387 JS	1, 6, RE
VOGELSTRUISPOORT 384 JT	1, 3, 7, 8, 18
WAAIKRAAL 385 JT	7
WELTEVREDEN 381 JT	1, 2, 4, 8, 9, 10, 11, 12, 13, 14, 15, 16, RE
WEMMERSHUIS 379 JT	1, 6, RE
WINTERSHOEK 390 JS	5, 14
ZOEKOP 426 JS	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 15, 21, RE

Plan 18: Viewshed for Weltevreden

2.1.1.18 Traffic and Safety

A basic traffic count was conducted on the R33 at the entrance to the site. A full traffic survey was not undertaken as the final destination and method of transport has not yet been finalised. The table below shows the results of the traffic count.

Table 43: Traffic count results.

Traffic Count - R33 passing entrance to Weltevreden						
Time	**Cars**	**Trucks**	**Mini Buses**	**Buses**	**Bicycle**	**Total**
07:30 - 08:00	13	18	0	0	0	31
12:00 - 12:30	18	16	0	0	0	34
16:15 - 16:45	22	14	2	0	0	38
Total	**53**	**48**	**2**	**0**	**0**	**103**

The majority of use of the R33 is through passenger car and truck use. The traffic count showed that the road does carry substantial traffic during the week. This will require Northern Coal to build an intersection for access to Weltevreden. This will be to ensure the safety of road users as the haul trucks will substantially increase traffic on the R33.

It is recommended that a full traffic study is completed before the operation of the mine and those necessary upgrades aspects such as intersections are completed before operation commences.

2.1.1.19 Regional socio-economic structure

The population of Emkhazeni Local Municipality amounts to 43 007 persons in accordance to Statistics South Africa which has been updated to currently being more than 59 000 persons as estimated by a Social Service Department study. This makes up 4.2% of the total of Nkangala District Municipality and 1.3% of the population of Mpumalanga (ELMIDP, 2007).

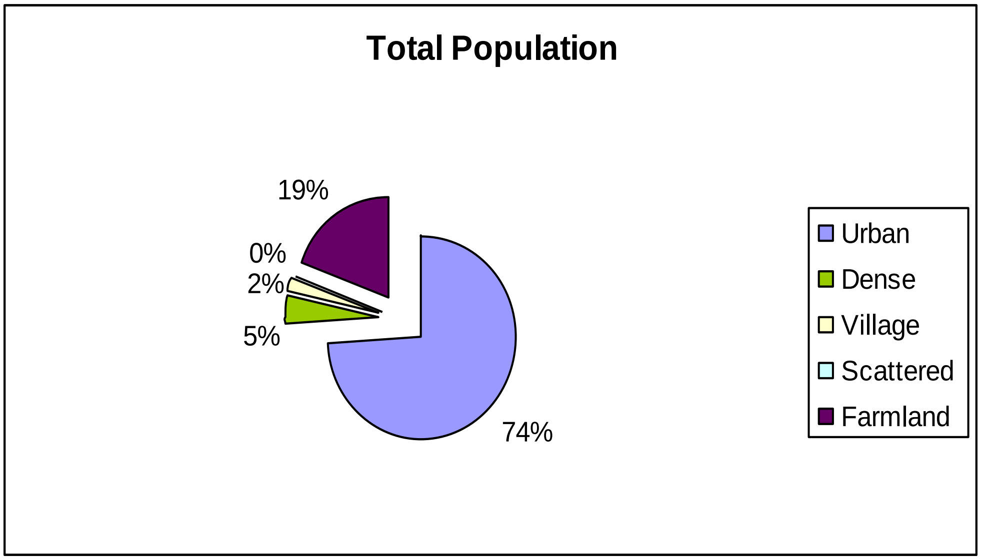


Figure 33: Population distribution of Emakhazeni Local Municipality (ELM IDP, 2007).

Approximately 39% of the population of Emakhazeni Local Municipality is economically active, while the overall unemployment amounts to 30%. The per capita income of employed people (age 15-65) was approximately R1700 per month. Approximately 54.5% of the employed population earned less than R800 per month, which is considered as living below the poverty line. 21.4% earned between R801 and R1600 per month, with 24.1% of the population earning more than R1 600 per month. The relatively low income levels are indicative of poverty and a high reliance on social assistance, specifically housing subsidies (ELM IDP, 2007).

Employment according to the major types of industry in the area was as follows:

- 26% work in agriculture and forestry;
- 5% work in mines and quarries;
- 13% work in private households;
- 14% work in wholesale and retail; and
- 11% work in community; social and personal services.

From this breakdown it is clear that most people in the area were employed in the primary and secondary sectors, with very few people employed in the tertiary sector (ELM IDP, 2007).

Access to basic services

The primary energy, secondary energy, water, communication and waste removal services are briefly outlined to provide an indication of the current access to services by residents of the Emakhazeni municipality.

The majority of households in Emakhazeni used coal for cooking purposes (37%), while 34% of households used electricity and 23% used wood. This corresponds with the type of fuel used for heating purposes. Approximately 37% of households used coal for heating purposes, 34% of households used electricity and 23% of households used wood (ELM IDP, 2007).

In terms of fuel used for lighting purposes, approximately 72% of households used electricity. The provision of electricity for lighting purposes increased with 1 921 units from 1996-2001 indicating that good progress was made with the provision of electricity to all households in the area (ELM IDP, 2007).

The majority of households (78%) had piped water inside their house or yard. The provision of water inside the house or on the stand increased with 1 133 units between 1996 and 2001. In terms of sanitation, the majority (69%) of households use flush toilets. The provision of flush/chemical toilets in houses increased with 1 811 units between 1996 and 2001(ELM IDP, 2007).

Approximately 61% of the households reported that the local authority removed refuse at least once a week. Access to basic services in the Emakhazeni area is therefore good and improvement is evident (ELM IDP, 2007).

Approximately 87% of all households had access to a telephone or cell phone within the location of their house which shows improvement in telecommunication access (ELM IDP, 2007).

Local community

A small community of farm labourers comprising of approximately 16 household/families reside on Zoekop (portion 1). The majority of these people work for Mr W. Pretorius and some of the labourers have been living here since 1985. A number of individuals are not employed by the farm and are working elsewhere in Belfast or surrounding farms. The loss of employment on the farm has led to the decrease in the number of people living in the area in the last two years. New comers are awarded a house by the farmer upon securing employment. There are no informal settlers on the farm and there has been no resettlement. The highest level of education attained by the few educated farm labourers is a matriculation certificate. The majority of community members are un-educated or have received very little education. Currently, the majority of children attend either the primary school or one of the two secondary schools located close to the settlement namely Nhlupheko Primary school, Morelig Secondary School and Khayalami Secondary in Siyathuthuka Township, Belfast

The second community is made up of scattered households on portion 16 of the farm Weltevreden 381 JT; consisting of approximately eight households in total, made up of about six people on average per household. There are no land claims over this land as far as the interviewees know. The location of their settlement is close to the project area, situated a few kilometres south of the project area. Subsequent to the passing away of the farm owner, Mr Louis Lotter, the majority of farm labourers moved out in search of new employment. Some of the families stated they have been living in this particular area for more than 20 years. The property falls under councillor Shakes Sibanyoni of the African National Congress (ANC) and under the Wonderfontein Community Association, a committee formed with its mandate being the protection of farm worker’s rights against exploitation by farmers and mines in the area. The primary source of income in the community is from agricultural (on a neighbouring farm). Others are employed as petrol attendants in Belfast while others farm small backyard gardens for subsistence and selling any excess produce. The highest level of education among the farm labourer community seems to be matriculation and the majority attended up to Secondary School. There currently one primary and one secondary school in the area catering for the educational needs of the children namely Bloemplaas Primary School and Khayalami Secondary school. The nearest tertiary institutions are located in Witbank, Nelspruit and Pretoria.

More socio-economic information is available as part of the sustainability assessment investigation attached in **Error! Reference source not found.**.

2.1.1.20 Sustainability assessment

The Sustainability Assessment Investigation Report is attached in Appendix M.

Triple Bottom Line

The goal of sustainability is contained in the Triple Bottom Line (TBL) approach, expanding the traditional reporting framework to consider ecological and social performance, in addition to financial performance (Wikipedia, 2009). The concept of TBL is based on shared responsibility from all stakeholders, which includes anyone who is influenced, either directly or indirectly, by the actions of a developer. The triple bottom line is made up of social, economic and environmental elements, also known as the "people, planet, profit" approach.

As a means of helping to focus the sustainability debate in South Africa, the Johannesburg Stock Exchange (JSE) has developed criteria to measure the triple bottom line performance of companies in the FTSE/JSE All Share Index, with the aim of compiling an Index comprising those companies that pass the Criteria requirements. The Social Responsibility Index (SRI) further offers a sustainability benchmark, recognising those listed companies incorporating sustainability principles into their everyday business practices and to serve as a tool for investors to assess companies on a broader base. The aim is for companies to use the index criteria as a South African standard against which good triple bottom line practices are measured (JSE SRI, 2009). During construction and operation, the Northern Coal Weltevreden Mine should consider integrating the SRI into their day-to-day operations.

In the pre-development context of the proposed Weltevreden Project, the triple bottom line approach can be used to assess potential impacts on the different receiving environments (Table 44). Evidently, both mining and agricultural activities impact on soil quality and water quality and quantity; however, agricultural activities are less destructive and soils are relatively easily reclaimed. Opencast mining activities are much more destructive towards the soils and geology and very difficult to reclaim, especially compaction once soil has been replaced. Therefore care must be taken during the reclamation process to prevent compaction on the one hand and to replace soil volumes back to a representative pre-mining soil and land capability while emulating the pre mining landscape.

Discussion

Due to the fact that the proposed project area is located in an area classified as high potential soil, surrounded by sensitive wetlands, the impact on the natural and biophysical environment will be negative. The impact on soils is considered as highly significant and irreplaceable. Subsequently, local and national food security may be affected in the long term if the agricultural potential of the soils are altered.

Conversely, the socio-economic impact on the proposed project area and surroundings are primarily beneficial and may create employment, training and education opportunities to local communities, whilst supporting the provincial and national economy through trade and commerce. If the correct environmental mitigation measures are implemented and stringent management guidelines are followed, the possibility for sustainable development may be viable. The successful implementation of environmental management plans cannot be guaranteed and the risk for mismanagement remains.

Cumulative impacts of mining already have a significant impact on the agricultural environment in the Mpumalanga Province and secondary effects from these impacts may negatively affect the socio-economic environment. Due to increasing threats of cumulative impacts on high potential soil in the region, it should be considered to implement a bioregional development plan to protect certain areas for farming to avoid the disappearance of the agricultural industry. If this area is earmarked for protection for agricultural development, the mining company will need to consider finding alternative coal resources in areas consisting of lower agricultural potential soils. However, a comprehensive bioregional development plan has not been implemented in this area yet.

Table 44: Triple Bottom Line Approach

Aspect	***People* (Social)**	***Planet* (Environment)**	***Profit* (Economy)**	**Time-frame**
Agriculture (No mining option)	The agricultural industry is currently the main regional employer, including long term seasonal employment with relatively low wages. Generally, minimum wages for farm workers in Urban areas for March 2007 – February 2008 is R5.34 per hour or R 1,041 per month and in Rural areas (March 2007 – February 2008) it is estimated at R5.07 per hour or R 989 per month.	Agricultural activities are focused on the production of food and generally cause less severe impacts to the environment than industrial development. Impacts can be divided into physical and chemical impacts on soil which are limited to the soil surface, normally considered to be the top soil of 300 – 350 mm of a soil profile. Grazing can potentially physically impact the soil surface due to compaction by animals while overgrazing may expose the soil surface to water runoff and therefore erosion. Cultivation of the soil is the main agricultural impact and physically deteriorates soil structure through the loss of organic matter as well as through compaction by machines. Cultivation quickens the breakdown and therefore loss of organic matter in soil. Overgrazing results in less available recyclable vegetation material to supplement soil organic matter content. Losing soil organic matter through cultivation or losing recyclable vegetation through overgrazing, increases the erosion potential of soils. The use of fertilisers, increased water utilisation and animal waste may affect the quality and quantity of surface and groundwater moderately.	Due to increased demands and support from authorities, agriculture is expected to grow in the region over the years; there are however, a few pertinent risks to the economic profitability of agriculture such as fluctuating markets, unstable economy, escalating fuel costs, transformation of land and climate change, resulting in a lower turnover on the short term. The current agricultural industry supports a profitable maize and cattle farming, as well as a cherry cultivation industry	Favourable Long term Sustainability Potential (50 years/ more)
Opencast Coal Mining	The proposed project may potentially create less than 50 full time jobs, including short-medium term	There are a number of adverse environmental effects of coal mining on the environment such as the release of green	The total ROM coal to be extracted is estimated at 7.512 Mt during the LoM of approximately 7 years. Mining will contribute towards South	Short – Medium term Sustainability

Aspect	***People* (Social)**	***Planet* (Environment)**	***Profit* (Economy)**	**Time-frame**
	employment that provides skills development and higher wages. Increased influx of foreign labourers could lead to social unrest and an additional influx of foreign workers. Minimum wage for surface miners in the coal mining industry estimates at R3 000 a month, and surface miners earns approximately R2 850 a month. .	house gasses, increased dust, Acid Mine Drainage, noise pollution, as well as the potential destruction of wetlands, which will directly and indirectly affect more 520ha directly and indirectly of arable land. Potential for contamination of local groundwater from oxidation of coal may occur and mining may also impact on local aquifers and surrounding water users.	Africa's foreign revenue through the generation of income and expenditure by employees. This will stimulate the local and national economy with a high turnover over short term. In terms of employment, skills creation and monetary terms, mining may contribute towards the regional economy,	Potential (8 years)

2.1.2 Environmental features that may require protection, remediation management or avoidance

No environmentally significant sites were located with in the proposed project area.The following table provides an indication of the required stratergy that will be needed in order to reduce the impacts on the various environmental features.

Table 45: Strategies for affected environmental features

Enviromental feature	Stratergy
Topography	Remediation
Soils	Remediation & management
Surface water	Management
Groundwater	Management
Wetlands	Avoidence, Remediation & management
Vegetation	Remediation and management
Noise	Management
Air quality	Managment
Blasting	Management
Floodplains	Avoidence

2.1.3 Closure or end use objectives

The overall closure objectives for the Weltevreden project are as follows:

- Return land, mined by opencast methods, to a land capability similar to that which existed prior to mining and that the management level required to utilise the rehabilitated land is within the means of the farmer who uses it;
- Ensure that as little water as possible seeps out of the various sections of the mine and where this is unavoidable, to ensure that the water is contained or treated if

the volume is significant and if it does not meet statutory water quality requirements;

- Remove all mine infrastructure that cannot be used by a subsequent land owner or a third party. Where buildings can be used by a third party, arrangements will be made to ensure their long term sustainable use;
- Clean up all coal stockpiles and loading areas and rehabilitate these to at least a grazing capability.
- Follow a process of closure that is progressive and integrated into the short and long term mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements;
- Form active partnerships with local communities to take of management of the land after mining, where possible; and
- To maintain and monitor all rehabilitated areas following re-vegetation or capping and, if monitoring shows that the objectives have been met, making an application for closure.

2.2 SECTION 39(3)(B)(I)

"Investigate, assess and evaluate the impact of his or her proposed prospectiong or mining operations on...... (i) the environment."

2.2.1 Project description

2.2.1.1 Project introduction

The Northern Coal Weltevreden Project comprises of the opencast mining of the No. 2 Seam of the Witbank coal field. The seam thickness varies from 1.2m in the north section of the mining area to 4.15m in the south west portion.

The mining method that will be undertaken in order to remove the coal seam will be truck and shovel roll over method at an average strip ratio of 5:1. An estimated 187.51ha will be disturbed which equates to approximately 38% of the total project area which is in line with the available coal reserve on the proposed project site. The total ROM coal to be extracted is estimated at 7.512Mt during the LoM of approximately 7 years.

The coal is at an adequate quality to supply Eskom for the purpose of power generation without further beneficiation apart from destining. There will therefore be no beneficiation process will be occurring on the Weltevreden Project site. Extracted coal will be crushed and placed on a ROM (stockpile). The ROM coal will then be transported off site.

2.2.1.2 Coal deposit

The Northern Coal Weltevreden Project involves the opencast mining of the No. 2 Seam of the Witbank coal field. The seam thickness varies from 1.2m in the north section of the mining area to 4.15m in the south west portion. The coal deposit is a 'C' grade coal which is ideal for sale to Eskom. Table 46 provides a comparison between the Eskom specification and the coal reserve on Weltevreden and indicates that the coal reserve to be mined meets the Eskom specification requirements.

Table 46: Eskom specification versus coal reserve on Weltevreden

	Eskom Specification	Weltevreden ROM (Raw)
Calorific Value (MJ/kg)	> 20	22.18 average
Ash content (%)	< 30	24.74 average
Volatile content (%)	>21	22.00 average
Sulphur content (%)	<1.5	0.94 average

The total ROM coal to be extracted is estimated at 7.512Mt during the LoM of approximately 7 years.

2.2.1.3 Mining methods

The mining method that will be undertaken in order to remove the coal seam will be truck and shovel roll over method at an average strip ratio of 5:1. Roll over mining or strip mining is undertaken by creating an initial cut or strip which is mined out. When mining moves forward the second strip, the overburden from the second strip is backfilled into the initial cut. The overburden from the initial cut is used to backfill the final cut (Figure 34). An estimated 187.51ha will be disturbed which equates to approximately 38% of the total project area. The opencast mining will be undertaken in three phases or sections which will result in the coal resource to be mined through three consecutive pits. Plan 3 provides a conceptual mine plan which indicates how the proposed opencast area has been divided into three pits and the direction of the proposed strip mining. Mining will be undertaken in this manner in order to stay outside of the 100 year flood lines of the intermittent stream that runs through the project area and outside of a 100m buffer zone from the stream or delineated wetland area (the area which is greater will be adhered to in accordance with Regulation 704. It is also necessary due to the high stripping ratio of the northern section of the coal reserve. Topsoil will be removed be fore the any mining activites re initiated.

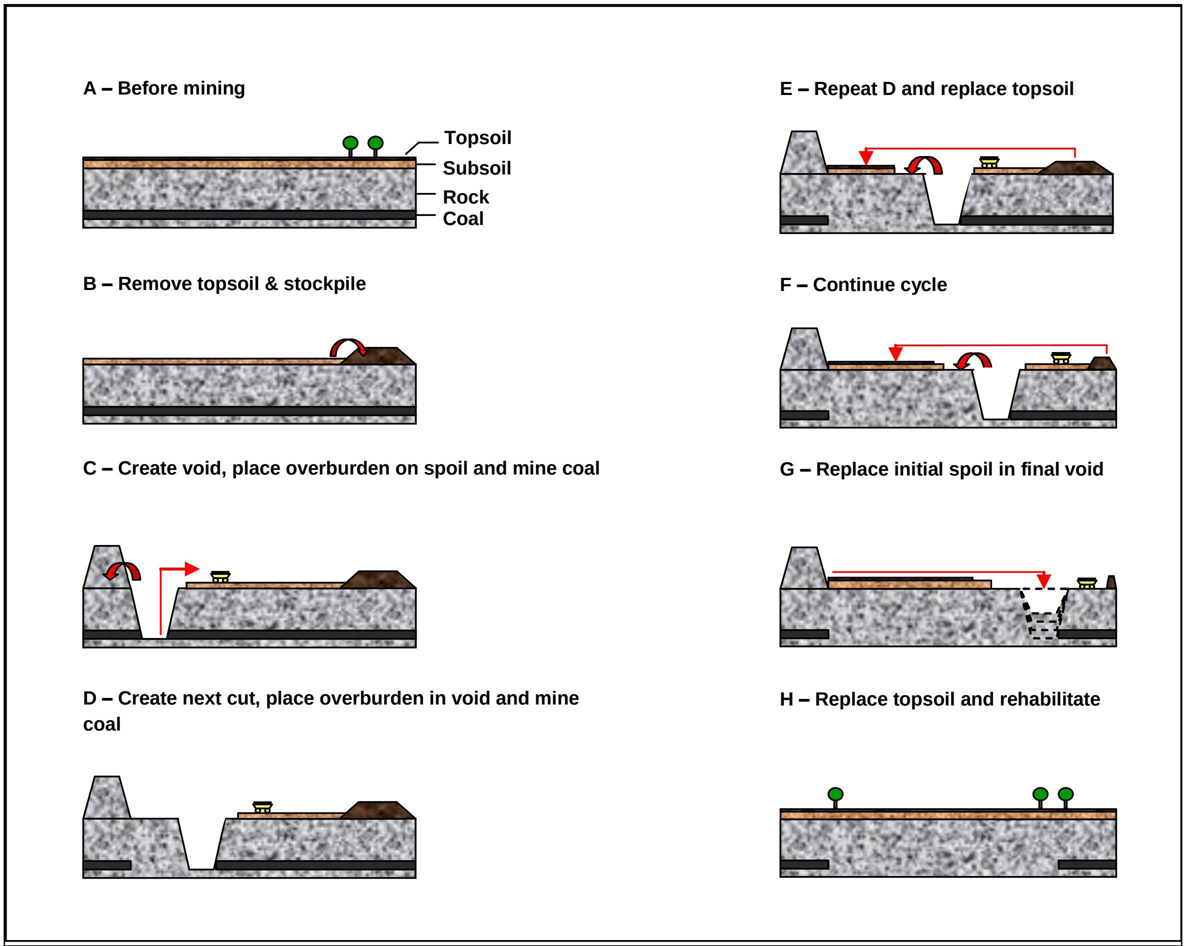


Figure 34: Illustration of strip mining

The coal does not require beneficiation. Table 46 above shows that the coal meets Eskom's specification which means that it is a low grade coal that will be un-economic to beneficiate. The coal deposit is therefore viable for sale directly to Eskom. Extracted coal will be crushed and placed on a ROM stockpile which will not exceed 5 000 tonnes. ROM coal will then be transported off site to its final destination which shall be an Eskom facility. The location of the opencast area as well as the associated infrastructure can be seen on the conceptual mine plan (Plan 19).

2.2.1.4 Coal market

The coal extracted as part of the proposed Weltevreden project is bound for the inland market. Negotiations between Eskom and Northern Coal have been undertaken in order to secure supply to a nearby Eskom Utility. Proof of correspondence between Eskom and Northern Coal has been included in Appendix N.

2.2.1.5 .Mine infrastructure and servitudes

Minimal mine infrastructure will be developed for the Weltevreden Project. A small scale portable crusher plant will be established on site. Electricity will be obtained from the current power supply crossing the farm with permission from Eskom. This power line will also be moved before mining operations commence and Northern Coal will construct an 11kV power line to the operation. Other infrastructure includes a portable temporary office and toilets and portable water storage tanks for domestic use. A 46m^3 above ground storage for hydrocarbons will be placed within a bunded area. A haul road will be constructed from the R33 to the mining area and will have a width of 8m and will be approximately 2km long. Temporary change houses will be placed on site. A diesel workshop will be constructed for maintenance of mine machinery. An explosive magazine will be placed on site. Water diversion berms will be built for dirty water/clean water separation. Areas will be cleared and concreted for waste management purposes. There will be a topsoil stockpile for rehabilitation purposes and an overburden stockpile for the final void

Plan 19: Conceptual mine plan

2.2.1.6 Employment figures

Northern Coal will employee 45 permanent employees and 95 contracted employees. The following table (Table 47) represents the labour sending areas for the required Weltevreden workforce.

Table 47: Labour sending areas for Weltevreden expected workforce

Municipality	Township	Employees
Emakhazeni	Belfast/Siyathuthuka	26
	Machadodorp/Emthonjeni	3
	Waterval Boven/Emgwenya	1
	Dullstroom/Sakhelwe	7
	Rural Area	8
Total		45

Northern Coal will implement a skills development plan that focuses on equipping employees with skills to promote their progression in the mining industry and their development into other sectors according to their aspirations. Northern Coal will ensure that a minimum of 40% of its management staff is composed of HDSAs within five years of the mining right being granted.

2.2.2 Waste management

2.2.2.1 General waste

According to the National Environmental Management: Waste Act, Act No. 59 of 2008 (NEMWA) waste is defined as "any substance, whether or not that substance can be reduced, re-used, recycled and recovered":

(a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;

(b) which the generator has no further use for the purposes of production;

(c) that must be treated or disposed of; or

(d) that is identified as a waste by the Minister by notice in the Gazette,

and includes waste generated by the mining, medical or other sector, but—

a by-product is not considered waste; and

any portion of waste, once re-used, recycled and recovered, ceases to be waste.

General waste means waste that does not pose an immediate hazard or threat to health or to the environment, and includes:

(a) domestic waste;

(b) building and demolition waste;

(c) business waste; and

(d) inert waste.

General waste will be disposed of at a licensed site in the Steve Tshwete Municipality, near Middelburg 70km from Belfast. General waste will be stored in waste disposal skips that will be placed on a concrete surface and will be covered while awaiting removal.

2.2.2.2 Hazardous waste

The definition of hazardous waste in accordance with NEMWA refers to any waste that contains organic or inorganic elements or compounds that may owing to the inherent physical, chemical or toxicological characteristics of that waste have a detrimental impact on health and the environment. Examples of hazardous waste include certain solvents, grease and oil. All hazardous waste will need to be disposed of at Holfontein Hazardous Waste Site. All hazardous waste will be stored in a bunded area while awaiting removal off site for final disposal.

2.2.2.3 Mine waste

As no beneficiation is taking place on site there will be no mine waste, by-products or fines generated from the operation. The coal spillages that do occur on site during loading will be collected and placed on the trucks transporting ROM coal. The ROM stockpile and crusher will be placed on a concrete surface to allow for easy clean up of spillages.

2.2.2.4 Sewage Effluent

A sufficient number of chemical toilets will be provided on site to service all staff. The facilities will be maintained by a reputable contractor and sewage will be removed from site and treated at a suitable sewage treatment works. The closest licensed sewage treatment works to the site is Belfast (this has been verified with the Belfast Municipality).

2.2.3 Water use and resources

The current use of water is determined by the land usage. The surrounding land use is agricultural in nature and is sparsely populated by farm owners, tenants and farm labourers. Agricultural activities consist of crop farming, where soil conditions are favourable, and stock farming. The water resources available are small streams and pans and the groundwater yield from the weathered and fractured Karoo aquifers.

The water requirements for the proposed operation are minimal and will mainly be required for domestic use and dust suppression. The required domestic water will either be truck to the site by water tankers or abstraction will occur from surface water sources on site. No additional abstraction from groundwater is allowed in the X11D catchment. The possible abstraction from a surface water source will be included in the IWULA. No abstraction of water is envisaged form the mining activities.

In-pit dirty water will be used for dust suppression on haul roads and other denuded areas. Dust suppression has the potential to require a considerable amount of water. Northern Coal will investigate dust preventative methods that will reduce watering requirements. Approximately 7l/m^2/hour of water is required for dust suppression.

2.2.4 Storm water management

Storm water will be managed as per GN R704 of the NWA: Regulations on use of water for mining and related activities aimed at the protection of water resources (GG 20119 of 4 June 1999). Clean storm water will be directed away from the mining operations using berms and dirty water will be captured within the dirty area and directed towards the pollution control dam for settling and evaporation. The pollution control dam will be sized such that it will be able to contain the run-off from a 1:50 year storm event. The DWEA Best Practice Guidelines (BPG) for storm water management will in addition be implemented on site.

2.2.5 Transport

The final destination of coal will be to several coal power stations in the surrounding area. The following power stations are likely to be supplied from the Weltevreden Project can be seen in the table below.

Table 48: Power station likely to be supplied

Power Station	Distance form mine (km)
Arnot Power Station	45km
Hendrina Power Station	93km
Majuba Power Station	180km
Tutuka Power Station	202km
Lethabo Power Station	300km

The method of transport and the transport route that will be taken by the coal trucks will depend on the demand of the above mentioned power stations. It is clear that the road network within the entire Mpumalanga coal mining district is currently degrading due to the continual increase in heavy load haul trucks using the network to transport the coal from the supply to the consumer. The transportation of the coal via haul truck holds many disadvantages and will add to the already stressed road network and pose an increased safety risk on road users. It is estimated that approximately 127 truck loads will be leaving the site daily. Northern Coal will make use of the private Belfast rail siding when possible for the transport of coal via rail as certain Eskom utilities are able to receive coal by rail and this will result in shorter required road haulage.

A bus service will be provided for the transportation of the workers to site from the local towns. No accommodation will be provided on site for labourers, neither will they be allowed to reside within the local communities, unless sourced from them.

2.2.6 List of main activities, schedule and categorization

Depending on environmental approvals, it is anticipated that the Weltevreden project may be initiated in 2010. The following is the predicted timing for each of the phases:

- Construction phase – early 2010 to mid 2010;
- Operation phase – 2010 to 2017;
- Decommissioning – 2018 to 2019; and
- Post closure – 2019 to 2023.

Please find the mining sequence tables attached in Table 49 for all three pits.

Table 49: Summary of main mining activities

Phase/categorization	No	Activity
Construction	1	Removal of topsoil
	2	Construction of haul roads
	3	Construction of a hydrocarbon facility (fuel depot)
	4	Construction of offices and change houses
	5	Construction of pollution control dams
	6	Construction of storm water diversion berms
	7	Construction of portable crusher plant
	8	Construction of a workshop
	9	Placement 11kV electrical line
	10	Blasting
	11	Development of initial open cast cuts
	12	Stockpiling of soil and overburden from initial cuts
Operation	13	Transportation of coal
	14	Use and maintenance of haul roads
	15	Domestic and industrial waste storage and removal
	16	Hazardous waste storage and removal
	17	Operation of portable ablutions
	18	Operation of fuel depot
	19	Operation of pollution control dam and storm water management systems
	20	Removal of overburden and backfilling

	21	Mining process removal of coal
	22	Crushing of coal
	23	ROM coal Stockpile
	24	Maintenance of equipment
	25	Rehabilitation as mining progresses
Decommissioning	26	Removal of all infrastructure
	27	Filling of final void
	28	Spreading of sub-soils and topsoil
	29	Re-vegetation of disturbed areas
	30	Profiling and contouring of the area to preserve natural drainage lines
	31	Environmental monitoring of decommissioning activities

Plan 20: Activity Plan

2.2.7 Details of the engagement process with Interested an Affected Parties (I&APs)

Aims of public participation

The Public Participation Process (PPP) forms an integral part in the decision-making process. Consultation with Interested and Affected Parties (I&APs) is the only meaningful way through which to take account of locally relevant conditions, as opposed to imposing a socially and environmentally insensitive design onto an environment.

The intention of the PPP for the Weltevreden project was to ensure that all I&APs were given accurate and timely project information, and that all stakeholders were provided with equitable and effective opportunity to raise comments and concerns.

Public Participation aims to create an environment of informed and constructive participation for all parties interested in, or affected by, a proposed development. It is a two-way interaction, not aimed at avoiding conflict, but rather at facilitating a process in which people are included in the decision-making process.

Approach

Initial stakeholder identification

The initial stakeholder identification process comprised of a site visit and a comprehensive desktop study including:

- Maps to identify farmers and settlements in the project area;
- Reviewing of previous consultations undertaken in the area;
- Reference books and internet sites;
- Title deed searches; and
- A two-day site visit.

The Micro Consultation was undertaken on 16 & 17 July 2008. Landowners directly adjacent to the development property and in the vicinity of the area were consulted in person.

The objectives of the micro consultations were to:

- Explain the PPP and how it will be undertaken during the Weltevreden Project Process;
- Present the preliminary mine plan;
- Introduce the proposed development to farmers in the area;
- Distribute Background Information Documents (BID) that contained basic information with regard to the proposed development, information regarding the legal processes that would be undertaken and details of the specialist studies that would be conducted;
- Register I&AP's;
- Present stakeholders with an opportunity to express their opinions, concerns and comment;
- Record issues, concerns and suggestions before the Environmental Authorisation Processes commenced; and
- The purpose was not to provide a response/address issues at the meetings, but to record main issues of concern and to gather inputs from stakeholders to guide the process and specialist assessments.

Table 50: List of consulted landowners during micro consultation

	Name	Tel Number	Farm Name & Portion	Status
1.	Nico Kriek	082 494 1104	Portion 4 – Vogelstruispoort	Consulted – 16/07/08
2.	Jan & Jenny Potgieter	072 727 2070	Portion 1 – Vogelstruispoort	Consulted – 16/07/08
3.	Therésilda Lotter	084 250 3300	Portions 2, 15 & 16 – Weltevreden	Consulted – 28/07/08
4.	Ben Kotzé	082 561 6934	Portion 4 & 17 – Blyvooruitzicht	Consulted – 17/07/08
5.	Koos Pretorius	083 986 4400	Portion 10 – Zoekop	Consulted – 17/07/08
6.	Sameul Johannes Lundall	082 892 2417	Portion 8, 9, R – Weltevreden	Consulted – 17/07/08
7.	Pierre de Villiers	082 770 6141	Portion 1 – Blyvooruitzicht	Consulted – 16/07/08

	Name	Tel Number	Farm Name & Portion	Status
8.	Petri Badenhorst	082 443 3086	Portion 3 – Blyvooruitzicht	Consulted – 17/07/08
9.	André Viljoen	083 625 5157	Portion 4 – Zoekop	Unable to attend a meeting – requested that BID and other relevant information be submitted to him for comment. The BID, Registration Form, Land Tenure Map and Mine Plan were submitted via e-mail on 18 August 2008. Telephonic conversation confirmed that he has received the documentation in good order.
10.	Chris Botha	013 253 1053	Portion 15 - Leeuwbank	Consulted – 17/07/08
11.	Jan & Kowie Gerrits	083 771 1820	Portion 8 - Zoekop	Consulted – 17/07/08
12.	Gary de Bruin - farm was subsequently bought by Mr. Samson Sibande	082 338 5114	Portion 10 – Vogelstruispoort	Unable to attend a meeting – requested that BID and other relevant information be submitted to him for comment. The BID, Registration Form, Land Tenure Map and Mine Plan were submitted via e-mail on 18 August 2008.
13.	Bernard Green	079 477 3146	Portion 4 - Weltevreden	Consulted – 16/07/08
14.	Van Rooyen	082 375 8724	Portion 1 - Weltevreden	Consulted 04/03/09
15.	Willie Pretorius	083 388 4371	Portion 1 – Zoekop, portion 16 - Blyvooruitzicht	Consulted – 16/07/08
16.	Tinnie Griffiths	082 553 2388	Portion 3, 13, 15 – Vogelstruispoort	Consulted – 16/07/08
17.	Charles Griffiths	082 563 5905	Portion 5 – Blyvooruitzicht	BID (provided to his father, who indicated that he is representative of his son)
18.	Morris Schupe	082 707 4807	Portion 1 - Weltevreden	Consulted – 16/07/08

Site visits

The following site visits were undertaken as part of the PPP for the Weltevreden Project:

- 16 & 17 July 2008– Micro Consultations with directly affected and surrounding landowners;
- 26 February2009 – to place site notices and distribute notifications of the public meeting and copies of the environmental scoping report on CD.

Documentation developed

Various information sharing documents were compiled to disseminate information about the proposed project, the public participation process and information sharing meetings. The documentation developed is described below.

Background Information Document (BID)

A BID was compiled and distributed to all I&APs. The BID included information regarding the locality and extent of the proposed project, a description of the project, as well as the Environmental Authorisation and Public Participation Processes that would be followed. The BID included the terms of reference for specialist studies that were undertaken as part of the EIA process. It should be noted that this was not a technical document, but provided I&APs with detailed and understandable information about the proposed project.

A comment and registration sheet was included as part of the BID. This provided I&APs with an opportunity to raise any issues, comments, and concerns regarding the proposed project, and to register as I&APs.

Advertisements and On-site Notices

In compliance with environmental regulations, advertisements were placed in the Middelburg Observer and the Lowvelder on 27 February 2009. The objectives of these newspaper advertisements were to:

- Inform I&APs of the proposed project;
- Inform I&APs of the public meeting;
- Inform I&APs of the availability of the environmental scoping report for public review; and

- Invite I&APs to become involved in the proposed project by registering as I&APs.

Site notices were placed in the vicinity of the site on 27 February 2009.

Stakeholder meetings

Micro Consultations – 16 & 17 July 2008

A number of issues were raised during the Micro Consultation Meetings. Basic information of current agricultural activities that are being undertaken in the area was also gathered. The main issues are summarised in

Table **51** below. The Issues and Response Report was made available to stakeholders on 19 August 2008 for comment. The complete issues and response tables are included in Appendix N, as they were seen as to extensive in length to include in the main EIA document.

The main outcome of the Micro Consultation meetings was that the Terms of Reference (TOR) for the Specialist Assessments needed to be agreed upon. It was also established that a number of additional studies would need to be undertaken. This was taken into consideration and the BID was amended to include the updated TOR and additional studies. An amendment was also made to the project description. It was initially communicated that the mined coal will be transported to Mimosa Colliery for processing. It was subsequently decided that the coal will not be taken to Mimosa Colliery for processing but that it would be crushed on site and taken directly to Eskom. The amended BID was distributed to identified stakeholders on 18 August 2008 with an opportunity to comment.

Micro Stakeholder Meeting – 23 September 2008

A Micro Stakeholder Meeting was held on 23 September 2008 on request of Dr. Pretorius. The objectives of the meeting were to discuss the TOR of the Specialist Assessments and the Environmental Authorisation Process that would be followed. The minutes of the meeting is attached in the PPP report. (Appendix N)

Authorities Information Sharing Meeting

An authority's information sharing meeting was held on 12 March 2009 at the Belfast Royal Hotel at 10h00. The proceedings of the meeting are attached in the PPP report. (Appendix N).

Public Information Sharing Meeting

A public information sharing meeting was held on 12 March 2009 at the Belfast Royal Hotel at 14h00. The proceedings and discussions of the meeting is attached in the PPP report (Appendix N)

Community Meeting

Two separate social consultations took place. The first was with the farm labourers residing on Willie Pretorius's farm Zoekop portion 1 and the second with the labourers residing on Theresilda Lotter's property Weltevreden 381 JT portion 16. The results are discussed in the farm labourer consultation report which is appended to the PPP report.

Public Feedback Meeting

A public feedback meeting was held on 12 August 2009 at the Belfast Royal Hotel at 10h00. The proceedings and discussions of the meeting are attached in the PPP report.

Environmental Reports

Scoping Report

I&APs were afforded an opportunity to review the environmental scoping report in terms of NEMA (Act N0. 107 of 1998). The report was made available from 25 February to16 March 2009 before submission to the DM and from 25 February 2009 to 31 March 2009 in terms of NEMA regulations at the following locations:

- Digby Wells Website: www.digbywells.co.za;
- Belfast Public Library;
- The report was also made available on CD to I&APs (hand-delivered on 26 February 2009; and

- CD's of the report was also available at the public and authorities meetings that were held on 12 March 2009 in Belfast.

Comments received on the scoping report are attached in the PPP report (Appendix N).

Environmental Impact Assessment Report Environmental Management Plan (EIAR EMP) Report

Interested and Affected Parties were afforded an opportunity to review the EIA EMP report in terms of the National Environmental Management Act (Act N0. 107 of 1998). The report was made available from 24 July 2009 to 19 August 2009 before submission to the DM on 19 August 2009:

- Digby Wells Website: www.digbywells.co.za;
- Belfast Public Library; and
- The report was also made available on CD to I&APs on written request.

No comments were received in writing. However, issues were discussed/comments were raised at the public feedback meeting.

2.2.8 Physical impacts identifies by I&APs and State Departments

The I&APs raised a number of issues and concerns and the main impacts as perceived by the I&APs are listed in

Table **51**. A detailed issues and response trail is included in the PPP report (Error! Reference source not found.).

Table 51: Main issues/concerns raised during the consultation process

Impacts Raised by I&APs and State Departments		**Related back to Source Activity**	**Proposed Mitigatory measures**	**Phases**
Impacts Raised by I&APs				
Water	Mining activities will compromise the quality and quantity of	Removal of topsoil Construction of hydrocarbon storage facilities (including diesel tanks, wash	Engineered solutions for the protection of water resources will be designed and constructed to minimise	Construction Phase Operational Phase Decommissioning Phase

Impacts Raised by I&APs and State Departments		Related back to Source Activity	Proposed Mitigatory measures	Phases
	surface and groundwater water necessary for agricultural and domestic activities.	bays and oil/diesel separators and flammable liquid storage) Construction of offices and change houses Construction of storm water diversion berms Development of initial open cast cuts Stockpiling of soil and overburden from initial cuts Continuous removal of topsoil, overburden and coal from opencast areas Blasting Operation of portable ablutions Operation of pollution control dam and storm water management systems Removal of overburden and backfilling Mining process removal of coal ROM coal Stockpile Filling of final void Re-vegetation of disturbed areas Domestic and industrial waste storage and removal	and prevent the pollution of water resources. Water management will be ongoing throughout the life of the mine. This will ensure that the potential pollution of the water resources due to the incorrect handling of dirty water and wastes will be minimised. Surface water impacts have been assessed in detail in the EIA report and proposed mitigatory measures included in the management plan.	
Biodiversity	The mining development will alter the biodiversity of the area.	Removal of topsoil Construction of haul roads Construction of offices and change	As per fauna and flora impact assessment.	As per fauna and flora impact assessment.

Impacts Raised by I&APs and State Departments		Related back to Source Activity	Proposed Mitigatory measures	Phases
		houses Development of initial open cast cuts Construction of pollution control dam and storm water management systems Construction of portable crusher plant Use and maintenance of haul roads Domestic and industrial waste storage and removal		
Traffic	Increase in construction vehicle traffic on local roads, creating safety hazards for residents and farmers in the area. Damage to / degradation of local roads from heavy trucks.	Construction of pollution control dam and storm water management systems Construction of portable crusher plant Construction of hydrocarbon storage facilities (including diesel tanks, wash bays and oil/diesel separators and flammable liquid storage) Development of initial open cast cuts Stockpiling of soil and overburden from initial cuts Continuous removal of topsoil, overburden and coal from opencast areas Construction of storm water diversion berms Mining process removal of coal Construction of a workshop Use and maintenance	As per traffic impact assessment	As per traffic impact assessment

Impacts Raised by I&APs and State Departments		**Related back to Source Activity**	**Proposed Mitigatory measures**	**Phases**
		of haul roads Domestic and industrial waste storage and removal		
Air Quality	Impacts of coal dust on agricultural crops and forestry plantations will hinder photosynthesis process and reduce crop quality. Dust emissions as a result from demolishing of infrastructure and clearing of the site will impact on neighbouring residents and agricultural crops.	Removal of topsoil Blasting Construction of haul roads Construction of pollution control dam and storm water management systems Mining process removal of coal Construction of a workshop Use and maintenance of haul roads	As per air quality assessment	As per air quality assessment
Soil	The soil characteristics of the development site will be altered by the time the decommissionin g phase commences.	Removal of topsoil Stockpiling of soil and overburden from initial cuts Rehabilitation as mining progresses Spreading of sub-soils and topsoil Re-vegetation of disturbed areas Domestic and industrial waste storage and removal	As per soil impact assessment	As per soil impact assessment.
Loss of Agricultural Land	Land will be lost for undertaking agricultural activities.	Removal of topsoil Stockpiling of soil and overburden from initial cuts Spreading of sub-soils	As per soil impact assessment.	As per soil impact assessment.

Impacts Raised by I&APs and State Departments		Related back to Source Activity	Proposed Mitigatory measures	Phases
		and topsoil Mining process removal of coal Blasting Development of initial open cast cuts Continuous removal of topsoil, overburden and coal from opencast areas		
Vibrations	Damage to structures surrounding the mining site as a result of vibrations and air blasts associated with blasting.	Blasting	As per blasting impact assessment.	As per blasting impact assessment.
Visual		Removal of topsoil Construction of offices and change houses Construction of pollution control dams Construction of portable crusher plant Blasting Mining process removal of coal Development of initial open cast cuts Stockpiling of soil and overburden from initial cuts	As per visual impact assessment	As per visual impact assessment
Noise	Construction activities will have noise impacts on neighbours - reverse hooters, construction vehicles.	Blasting Construction of hydrocarbon storage facilities (including diesel tanks, wash bays and oil/diesel separators and flammable liquid	As per noise impact assessment	As per noise impact assessment

Impacts Raised by I&APs and State Departments		Related back to Source Activity	Proposed Mitigatory measures	Phases
	Operational activities will have noise impacts on neighbours - reverse hooters, operation of the crushing plant, trucks. Noise associated with closure activities will impact on neighbouring farms and residents.	storage) Construction of offices and change houses Construction of pollution control dam and storm water management systems Construction of portable crusher plant Mining process removal of coal		
Impacts Raised by State Departments				
Mpumalanga Tourism and Parks Agency				
Aquatic Fauna	Risk of acid mine drainage on aquatic fauna.	Development of initial open cast cuts Continuous removal of topsoil, overburden and coal from opencast areas	Mining process removal of coal Development of initial open cast cuts Continuous removal of topsoil, overburden and coal from opencast areas	As per groundwater / hydro-geological impact assessment.
Flora	Impacts of mining development on threatened plant species in the area.	Removal of topsoil Construction of hydrocarbon storage facilities (including diesel tanks, wash bays and oil/diesel separators and flammable liquid storage) Construction of offices and change houses Construction of storm water diversion berms Development of initial open cast cuts Stockpiling of soil	As per fauna & flora impact assessment.	As per fauna & flora impact assessment.

Impacts Raised by I&APs and State Departments		**Related back to Source Activity**	**Proposed Mitigatory measures**	**Phases**
		and overburden from initial cuts Continuous removal of topsoil, overburden and coal from opencast areas Blasting Operation of portable ablutions Operation of pollution control dam and storm water management systems Removal of overburden and backfilling Mining process removal of coal ROM coal Stockpile Filling of final void Re-vegetation of disturbed areas Domestic and industrial waste storage and removal		
Biodiversity	Dewatering of wetlands. Impacts of mining development on the migration Blue Cranes, Wattled Cranes and Flamingos.	Removal of topsoil Construction of hydrocarbon storage facilities (including diesel tanks, wash bays and oil/diesel separators and flammable liquid storage) Construction of offices and change houses Construction of storm water diversion berms Development of initial open cast cuts Stockpiling of soil and overburden from	As per aquatic and fauna and flora impact assessments	As per aquatic and fauna and flora impact assessments

Impacts Raised by I&APs and State Departments		Related back to Source Activity	Proposed Mitigatory measures	Phases
		initial cuts Continuous removal of topsoil, overburden and coal from opencast areas Blasting Operation of portable ablutions Operation of pollution control dam and storm water management systems Removal of overburden and backfilling Mining process removal of coal ROM coal Stockpile Filling of final void Re-vegetation of disturbed areas Domestic and industrial waste storage and removal		

2.2.9 Potential impacts of the main mining activities and assessment thereof

These impacts were further categorised into the different phases of the project (i.e. construction, operational, decommissioning and post closure phases) and assessed according to their severity, spatial scale, duration and probability.

The complete results of the impact assessment for all activities are included in are Appendix O. This is due to the length of the matrix and to prevent fatigue during reading of the document. The impacts of high to medium high significance have been extracted from the complete matrix to provide a summary of the identified significant impacts for the phases of Weltevreden Project. The tables below provide a summary of the significant impact for the construction, operation and decommissioning phases of the proposed project.

Construction phase

The most significant impacts that are expected to occur during the construction phase include the impacts on soil, groundwater, surface water and sensitive landscapes. The clearing of topsoil for the infrastructure and initial pit will result in the loss of the natural soil distribution and soil properties. This is expected to have a negative impact of medium-high significance on the soils on site.

The establishment of the initial pit could cause dewatering of the surrounding aquifers. This will have a negative impact of medium-high significance on the local groundwater resources. The removal of vegetation will increase the possibility of erosion and siltation of surface water resources would result from this. In addition it will also result in the loss of natural habitat. The significance of these impacts are expected to be medium-high. The change inflow dynamics of surface runoff will impact on both the wetlands and the surface water. This will have a high significance.

Table 52: Summary of significant impacts during the construction phase

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
1	Removal of topsoil	1.1	Soils	Loss of the original spatial distribution of soil types and natural soil horizon sequences.	N	5	1	5	10	5	73
		1.2		Loss of soil fertility, original soil depth and volume, as well as natural soil functioning.	N	5	1	4	9	5	63
		1.3		Compaction of soil due to movement of heavy construction vehicles.	N	5	1	3	8	5	60
		1.4	Land capability	Land capability will be reduced in areas stripped of topsoil, due to loss of soil fertility, original soil depth and volume, as well as natural soil functioning and soil compaction.	N	4	1	3	8	5	53
		1.5	Land use	Change of current land uses to mining. Very severe in areas occupied by agriculture.	N	4	1	3	8	5	53

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		1.6	Sensitive landscape (Wetlands)	Sedimentation of the water resources due to erosion of the overburden during periods of high rainfall. Topsoil and overburden stripping and vegetation removal reduces recharge of shallow aquifers that feed hillslope wetlands, reducing flow in water resources. This activity will increase the erosion potential of the area.	N	4	3	3	10	4	53
		1.9	Natural vegetation	Removal of topsoil will lead to the removal of vegetation that is binding the soil and this activity will increase the erosion potential of the area.	N	4	3	3	10	5	67
		1.10	Fauna (mammals, birds, amphibians, reptiles, insects)	Topsoil removal results in the destruction of natural habitats for animals	N	4	3	3	10	5	67

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		1.11	Topography	Removal of topsoil and weathered material from construction areas results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate sections.	N	4	1	4	9	5	60
		1.14	Surface water	Siltation as a result of dust created during topsoil removal, transportation and storage. Erosion of the stockpiles and excavated areas. Contamination of surface water by dirty water from the stockpiles and overburden dug out during the construction phase.	N	3	2	3	8	5	53
		1.14	Surface water	Potential localised flooding due to increase in surface run-off quantity and changes to surface water flow dynamics during the process of vegetation and topsoil removal.	N	4	4	3	11	4	59

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
2	Construction of haul roads	2.4	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas and hard and steep surfaces will increase the velocity of runoff.	N	3	3	3	9	5	60
		2.7	Natural vegetation	When the haul road is constructed, vegetation will be removed.	N	4	3	3	10	4	53
		2.8	Fauna (mammals, birds, amphibians, reptiles, insects)	removal of vegetation will destroy the natural habitats of animals	N	4	3	3	10	4	53
3	Construction of hydrocarbon storage facilities (including diesel tanks,	3.7	Surface water	Hydrocarbon contamination from diesel spillages during the set up of fuel bays and from leaks of trucks filling up.	N	4	2	4	10	4	53

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
	wash bays and oil/diesel separators and flammable liquid storage)										
4	Construction of offices and change houses	4.4	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas.	N	3	3	3	9	5	60
		4.6	Natural vegetation	construction of offices and change house will lead to clearing of vegetation	N	4	3	3	10	4	53
		4.7	Fauna (mammals, birds, amphibians, reptiles, insects)	construction of offices and change house will lead to clearing of vegetation and destroying the natural habitats of animals	N	4	3	3	10	4	53

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
4	Construction of offices and change houses	5.13	Surface water	Prevention of surface water resources pollution by dirty water through the construction of water pollution control dams.	P	2	5	3	10	5	67
6	Construction of storm water diversion berms	6.1	Sensitive landscape (Wetlands)	Loss of water from the natural system due to the channeling of water away from seepage areas and water resources as well as pollution of the diverted clean water by mining activities	N	3	3	3	9	5	60
		6.4	surface water	Storm water diversions will alter the flow dynamics of surface water thereby reducing the amount of runoff reporting to the catchment. The dirty area should be maximized where possible.	N	4	3	3	10	4	53
7	Construction of portable crusher plant	7.1	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas.	N	3	3	3	9	5	60

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
8	Construction of a workshop	8.4	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas.	N	3	3	3	9	5	60
10	Blasting	10.2	Noise	Blasting during boxcut establishment will cause noise and vibration		4	3	3	10	5	67
		10.3	Topography	Blasting of rock results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics.	N	4	1	4	9	5	60
		10.5	Geology	Blasting will alter lithologies, thus changing the geologic profile of the disturbed area.	N	5	1	5	11	5	73
		10.8	Air blasting	Blasting activities will result in fly rock which may impact structures close to blasting activities	N	4	2	4	10	4	53

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		10.9	Vibration	Blasting activities will result in ground vibration that may result in structural damage to surrounding infrastructure	N	4	3	4	11	4	59
11	Development of initial open cast cuts	11.1	Sensitive landscape (Wetlands)	Establishment of opencast areas dewaters surrounding aquifers	N	5	3	5	13	5	87
		11.4	Natural vegetation	vegetation will be cleared and removed during the development of opencast	N	4	3	3	10	4	53
		11.5	Topography	The establishment of initial open cast cut and access ramps results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate sections.	N	4	1	4	9	5	60
		11.7	Fauna (mammals, birds,	Habitats will be destroyed during the development of opencast	N	4	3	3	10	4	53

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
			amphibians, reptiles, insects)								
		11.8	Groundwater	Establishment of opencast pit dewaters surrounding aquifers	N	4	2	3	9	5	60
	Initial box cut	11.9	Surface water	Alteration of flow dynamics due to dewatering of the surrounding aquifer (through pumping out of water in order to ensure that the mine site is dry). This results in depleting the nearby streams with essential base flow and substantially reduces the catchment size and changes the surface water flow dynamics	N	4	5	3	12	5	80
12	Stockpiling of soil and overburden from initial cuts	12.1	Soils	Loss of soil fertility and natural soil functioning due to mixing of soil types.	N	4	1	4	9	5	60
		12.2	Soils	Compaction of soil during stockpiling.	N	4	1	3	8	5	53

Construction Phase											
Activity No	Activity Description	Impact Ref No	Affected environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		12.10	Surface water	Acid mine drainage formation from prolonged exposure of the overburden excavated from the initial boxcut to rain and air. AMD impacts surface water quality on a national/international scale since the stream passing through the proposed mining area is international.	N	4	5	4	13	5	87

Operational phase

The continuous removal of overburden and inter burden from the mining pits and the transportation of the material will result in the soil compaction and the loss of soil nutrients this will have an impact on both the soil and potential land capability. It could also lead to an increase in wind and water erosion. This is expected to have a negative impact of medium-high significance on the soils on site.

The potential contamination of surface and groundwater resources from dirty water or hydrocarbon spillages could adversely affect the quality of these resources. The reduction in the catchment size reduces the quantity of water reaching water resources and the sensitive areas. During mining there is the potential for acid mine drainage which will have a significant impact on both water resources and sensitive landscapes. This impact is expected to have a high significance.

The removal of vegetation results in the destruction of habitats of the local fauna. This has a medium-high significant impact on the fauna living on site and in the area.

The perceived significant impacts of the I&APs are related to various environmental aspects, however, impacts on groundwater, surface water and loss of biodiversity are seen to be the most significant.

The table below summaries the most significant impacts identified, during the operational phase.

Table 53: Summary of significant impacts during the operational phase

Operational Phase											
Activity No	Activity Description	Impact Ref No	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
1	Removal of topsoil	1.1	Soils	Loss of the original spatial distribution of soil types and natural soil	N	5	1	5	11	5	73

Operational Phase											
Activity No	Activity Description	Impact Ref No	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
				horizon sequences.							
		1.2	Soils	Loss of soil fertility, original soil depth and volume, as well as natural soil functioning.	N	5	1	4	10	5	67
		1.3	Soils	Compaction of soil due to movement of heavy mining vehicles.	N	5	1	3	9	5	60
		1.4	Land capability	Land capability will be reduced in areas stripped of topsoil, due to loss of soil fertility, original soil depth and volume, as well as natural soil functioning and soil compaction.	N	4	1	3	8	5	53
		1.5	Land use	Change of current land uses to mining. Very severe in areas occupied by agriculture.	N	4	1	3	8	5	53
		1.6	Natural environment	removal of topsoil will lead to vegetation loss	N	4	3	3	10	4	53
		1.7	Fauna (mammals, birds, reptiles, insects)	habitat will be destructed by the removal of topsoil	N	4	3	3	10	4	53

Operational Phase											
Activity No	Activity Description	Impact Ref No	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		1.1	Sensitive landscape (Wetlands)	Sedimentation of the water resources due to erosion of the overburden during periods of high rainfall. Topsoil and overburden stripping and vegetation removal reduces recharge of shallow aquifers that feed hillslope wetlands, reducing flow in water resources. This activity will increase the erosion potential of the area.	N	4	3	3	10	4	53
		1.1	Air Quality	The stripping of topsoil, exposing subsoil will impact on the dust fallout levels as well as the PM10 levels	N	3	2	3	8	5	53
	Continuous removal of topsoil, overburden and coal from opencast areas	1.1	Surface water	Acid mine drainage - There is a risk of the formation of AMD when stockpiling and exposing the overburden excavated from opencast pits to rain. The exposed coal is also susceptible to AMD formation. AMD impacts surface water quality on an international scale.	N	4	5	4	13	5	87
		1.1	Surface water	Decant - There is a possibility of water affected by AMD to decant from in-pit areas to surface water. The AMD could be transported off site and will affect surface water	N	4	5	3	12	4	64

Operational Phase											
Activity No	Activity Description	Impact Ref No	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
				quality on an international scale.							
		1.1	Surface water	Altered surface water flow dynamics - The removal of overburden and mining of coal will reduce the catchment size, thereby decreasing the amount of water reporting to surface streams on and off site.	N	4	3	3	10	5	67
10	Blasting	10.2	Noise	Blasting during boxcut establishment will cause noise and vibration		4	3	3	10	5	67
		10.3	Topography	Blasting of rock results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics.	N	4	1	4	9	5	60
		10.4	Groundwater	There is a risk of the formation of AMD when stockpiling and exposing the overburden and coal excavated from the opencast areas to rain. Exposed coal can also form AMD. AMD impacts groundwater quality on a regional scale.	N	4	3	3	10	4	53

Operational Phase											
Activity No	Activity Description	Impact Ref No	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		10.8	I&APs	Blasting will impact on surrounding structures and may be nuisance to people living in close proximity to the site	N	3	3	3	9	5	60
17	Operation of portable ablutions (water use)	17.6	Surface water	Decrease in imported (potable) water demand through re-cycling and re-use of in-pit water for the mine operations.	P	1	5	3	9	5	60
19	Operation of pollution control dam and storm water management systems	19.4	Surface water	Prevention of surface water resources pollution by dirty water during maintenance and cleaning of water pollution control dams.	P	2	5	3	10	5	67
20	Removal of overburden and backfilling	20.1	Sensitive landscape (Wetlands)	Sedimentation of the water resources due to erosion of the overburden during periods of high rainfall. Topsoil and overburden stripping and vegetation removal reduces recharge of shallow aquifers that feed hillslope wetlands, reducing flow in water resources.	N	4	3	3	10	4	53
		20.6	Groundwater	Dewatering- During the excavation of overburden from the opencast areas, aquifers could be intercepted. This could lead to the dewatering of surrounding aquifers and impact on groundwater users.	N	4	3	3	10	4	53

Operational Phase											
Activity No	Activity Description	Impact Ref No	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
21	Mining process removal of coal	21.1	Sensitive landscape (Wetlands)	Topsoil and overburden stripping and vegetation removal reduces recharge of shallow aquifers that feed hillslope wetlands, reducing flow in water resources. Establishment of opencast areas dewaters surrounding aquifers	N	5	3	5	13	5	87
		21.6	Surface water	AMD formation from prolonged exposure of the overburden excavated from the initial boxcut to rain and air. AMD impacts surface water quality on a national/international scale since the stream passing through the proposed mining area is international.	N	4	5	4	13	5	87
		21.7	Groundwater	Acid mine drainage - There is a risk of the formation of AMD when stockpiling and exposing the overburden and coal excavated from the opencast areas to rain. Exposed coal can also form AMD. AMD impacts groundwater quality on a regional scale.	N	5	3	3	11	5	73

Operational Phase											
Activity No	Activity Description	Impact Ref No	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		21.8	Surface water	As more areas are excavated for the removal of coal catchment will be further decreased. The conveyance of coal could result in siltation and deterioration of water quality from chemicals used during blasting. Diesel spillages from the transportation of coal can negatively impact on water quality.	N	4	5	4	13	5	87
23	ROM coal Stockpile	23.7	Groundwater	There is a risk of the formation of AMD when stockpiling and exposing the overburden and coal excavated from the opencast areas to rain. Exposed coal can also form AMD. AMD impacts groundwater quality on a regional scale.	N	4	3	3	10	4	53
25	Rehabilitation as mining progresses	25.1	Soils	Replacement of soil as part of rehabilitation.	P	2	1	5	8	5	53

Decommissioning phase

During the decommissioning phase the possible impacts on the surrounding environment will decrease. There will be the potential for AMD that will impact on water resources; however, this is seen to have medium-low significance.

Decommissioning is seen to have more significant positive impacts as during rehabilitation it will be attempted to re-shape the area of disturbance and to encourage vegetation growth.

The table below summaries the most significant impacts identified which includes positive impacts.

Table 54: Summary of significant impacts during the decommissioning phase

Decommissioning Phase											
Activity No.	Activity Description	Impact Ref No.	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
27	Filling of final void	27.1	Sensitive landscape (Wetlands)	Restoration and rehabilitation of sub-surface and surface flow dynamics. This is only achieved if soils are separately correctly and managed and the original soil profile is restored.	P	4	3	3	10	4	53
		27.5	Surface water	Dust from transporting of and during back filling (of final void) with the stored stockpile, Alteration of the free drainage system (natural flow of water). There might be impacts created by the presence of PCD if not maintained there could be loss of capacity from siltation and subsequent overflow to the receiving environment where surface water resources can be	N	4	5	4	13	4	69

Decommissioning Phase

Activity No.	Activity Description	Impact Ref No.	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
				impacted upon.							
28	Spreading of sub-soils and topsoil	28.1	Soils	Replacement of soil as part of rehabilitation.	P	2	1	5	8	5	53
		28.5	Sensitive landscape (Wetlands)	Attempt of the restoration and rehabilitation of sub-surface and surface flow dynamics. This is only achieved if soils are separately correctly and managed and the original soil profile is restored.	P	4	3	3	10	4	53
29	Re-vegetation of disturbed areas	29.1	Soils	Vegetation stabilizes soil particles and promotes cohesion, preventing soil erosion.	P	4	1	4	9	5	60
		29.8	Surface water	Re-establishment of the original (pre-mining) catchment and drainage characteristics of the mine site.	P	1	5	4	10	4	53
30	Profiling and contouring of the area to preserve natural drainage lines	30.1	Soils	Restoration of natural drainage lines will prevent water logging and consequent subsidence of replaced soil.	P	4	1	4	9	5	60

Decommissioning Phase											
Activity No.	Activity Description	Impact Ref No.	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
		30.9	Topography	Topographical contours and drainage line will be restored.	P	4	1	4	9	5	60

2.2.10 Assessment of potential impacts raised by I&APs and Sate Departments

Construction phase

Environmental Aspect	Affected Environment	Impact	Positive or Negative I	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
Traffic and Roads	Interested and Affected Parties	Increase in construction vehicle traffic on local roads, creating safety hazards for residents and farmers in the area.	N	3	4	3	10	5	67
Fauna and Flora	Fauna and Flora	The mining development will have a significant impact on the biodiversity of the area.	N	5	3	1	9	5	60

Operational phase

Environmental Aspect	Affected Environment	Impact	Positive or Negative	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
Dust and Air Quality	Interested and Affected Parties	Impacts of coal dust on agricultural crops and forestry plantations - will hinder photosynthesis process	N	5	2	3	10	5	67
Surface Water	Interested and Affected Parties	Compromising the quality of surface water necessary for agricultural activities	N	5	3	3	11	5	73
Ground Water	Interested and Affected Parties	Compromising the quality of groundwater necessary for agricultural activities and residential purposes	N	5	3	3	11	5	73
Noise	Interested and Affected Parties	Noise levels associated with construction activities will impact on neighboring farmers and residents	N	5	2	3	10	5	67
Traffic and Roads	Interested and Affected Parties	Increase on local roads, creating safety hazards for residents and farmers in the area. Damage to local roads from heavy trucks.	N	5	3	3	11	5	73
Blasting	Interested and Affected Parties	Structural damage to infrastructure and groundwater boreholes	N	5	2	4	11	4	58
Visual	Interested and Affected Parties	The mining operation will be visible from neighboring farms and for other residents of the area	N	5	2	3	10	5	67
Loss of agricultural land	Interested and Affected Parties	Agricultural land will be lost as a result of the mining operation.	N	5	1	4	10	4	53
Socio- Economic	Interested and Affected Parties	Employment opportunities will be created	P	3	3	3	9	5	60

Fauna & Flora	Fauna & Flora	The mining development will have a significant impact on the biodiversity of the area.	N	5	3	3	11	5	73
Noise	Interested and Affected Parties	Operational activities will have noise impacts on neighbors - reverse hooters, operation of the crushing plant, trucks.	N	5	2	3	10	5	67

Decomissioning phase

Environmental Aspect	Affected Environment	Impact	Positive or Negative Impact	Severity	Spatial Scale	Duration	CONSEQUENCE	PROBABILITY	Significance / 100%
Noise	Interested and Affected Parties	Noise associated with closure activities will impact on neighboring farms and residents.	N	5	2	2	9	5	60
Traffic and Roads	Interested and Affected Parties	Less traffic will be generated during the decommissioning phase. The number of trucks on the regional roads will be reduced.	P	5	3	2	10	5	67
Loss of agricultural land	Interested and Affected Parties	Agricultural land will be lost for the purposes of undertaking agricultural activities.	N	4	1	3	8	5	53
Soil & Land Capability	Interested and Affected Parties	The soil characteristics of the development site will be altered by the time the decommissioning phase commences.	N	4	1	3	8	5	53
Visual	Interested and Affected Parties	The activities associated with the decommissioning phase will be visible to neighboring farms and residents in the area.	N	5	2	2	9	5	60

Socio- Economic	Interested and Affected Parties	Jobs will be lost as a result of the closure of the mine.	N	5	3	3	1 1	5	73

2.2.11 Cumulative impacts

2.2.11.1 Soils

Although soil is a renewable resource, it takes hundreds of years to produce adequate topsoil. On a regional scale, current land uses such as agriculture and mining are exerting pressure on topsoil as limited and valuable resource. In fact, the impact of opencast coal mining on soil resources in South Africa increases on a daily basis as energy demands increases worldwide.

Opencast coal mining involves the removal and stockpiling of topsoil which leads to mixing of soil types and horizons, soil compaction, as well as changes to soil structure and fertility, ultimately resulting in the increased erodibility and loss of topsoil to wind and water erosion. Similarly, unsustainable agricultural practices can lead to a reduction in soil fertility and the compaction of soil layers. The risk of soil contamination by both activities is correspondingly high, as vehicles and equipment used in agriculture or mining spills hydrocarbons and lubricants.

The cumulative impact on soils in the study area can increase even more should new industrial, commercial and mining operations commence in the area. The impacts will be far ranging, resulting in soil erosion, siltation of local streams, loss of arable areas and the lack of sufficient topsoil for effective rehabilitation of opencast areas.

The cumulative impacts on soils are of high severity and will occur on a regional scale. The impacts will last beyond closure of the mine and are almost certain to occur. The impact severity is therefore of **medium-high** significance with a significance rating of **73/100**.

In order to mitigate these impacts, it is of utter importance that soil stripping, stockpiling and replacement is done according to the soil utilisation guide. The guide takes into account the varying structure, fertility and land capability of soil types and horizons and ensures that these inherent soil properties are not reduced or lost due to stripping and stockpiling.

2.2.11.2 Land capability

The region in which the proposed mining operations are to take place is characterised by some of the best high potential agricultural soils in South Africa. Large areas are covered with wetlands, which play a valuable role in the sustenance of ecological systems. In addition, opencast coal mining activities in the region are already exerting pressure on topsoil as limited and valuable resource. It is for this reason that the land capability of the region has been severely affected and future mining activities threatens to reduce land capability in the region even more.

The cumulative impacts on land capability are of high severity and will occur on a regional scale. Plan 19 shows that if all areas within a local radius are mined, the cumulative impact on the loss of high potential agricultural land will be highly significant. The impacts will last well beyond closure of the mine and is more than likely to occur. The cumulative impacts is therefore of **medium-high** significance with a significance rating of **73/100**.

In order to restore land capability to its pre-mining status, it is of utter importance that effective rehabilitation is planned and implemented. This will require the implementation of the soil utilisation guide, as discussed in the previous section.

2.2.11.3 Land use

The dominant land uses in the region are agriculture and mining. The ever increasing world-wide demand for coal has stimulated an increase in coal mining activities in South Africa. This has led to the loss of agricultural land by new mining operations. Similarly, a succession in land use types has occurred from agricultural land and even wilderness, to mining. The cumulative impact on land use is of moderate severity, occurs on a regional scale and is definite to occur. However, mining is a temporary land use and the impact therefore only lasts for the duration of the LOM. The cumulative impact on land use is therefore of **high** significance with a significance rating of **87/100**.

Plan 21: Cumulative Impact: Agricultural Potential.

2.2.11.4 Air Quality

All the activities included in the proposed mining project together with the activities occurring in the surrounding area will contribute to the possible cumulative impact on air quality in the area

Table 55: Estimated cumulative dust deposition

Cumulative Dust deposition mg/m2/day							
Mitigation at receptor level		**0% Mitigation**		**50% Mitigation**		**90% Mitigation**	
Receptor	**Avg**	**PC**	**Cumulative**	**PC**	**Cumulative**	**PC**	**Cumulative**
NOC 1	189.54	13.37	202.91	11.09	200.63	10.2	199.74
NOC2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NOC3	255.55	578.96	835.51	264.57	520.12	87.47	323.02
NOC4	329.79	29.36	359.16	20.33	350.18	14.38	344.17
NOC5	175.99	51.79	227.78	33.2	209.19	18.34	194.33

PC = Process Contribution

From the above table it can be concluded that Sample point NOC3 will experience the greatest cumulative impact as a result of all the proposed activities that will occur during the proposed mining project. This is due to this receptor been located on the proposed mining site. Unfortunately no data was available for the sampling period October 2008 to March 2009 for NOC2 in order to determine the cumulative impact at this position. Through mitigation cumulative impacts can be reduced.

The baseline dust fallout levels in the area are low. Presently dust generated in the area is predominantly caused by agricultural activities such as tractors used for ploughing and combine harvesters used for the harvesting of maize as well as vehicle entrainment from unpaved roads. Currently the cumulative impact of the agricultural activities has a **low** significance rating of **15/100**. This is due to the fact that agricultural activities only occur at specific times of the year and during the day time. If the proposed mining activities on the farm of Weltevreden take place, the cumulative dust fallout levels extending beyond the site boundary will increase slightly, as indicated in the above tables, and will cause the overall significance of the cumulative impacts of the project to increase to a **medium-low** significance rating of **25/100**. Blasting will cause high dust levels it is likely to settle out in close proximity to the source as can be seen on the dispersion models and has a limited impact because it is intermittent. In future the increase of mining activities due to more mines starting up in the area will contribute to the cumulative impacts on ambient air quality levels. The cumulative impacts caused by the increased mining activities in the area will have a **medium-high** significance rating of **50/100** due to increased blasting activities that only take place during daylight hours as well as an increase of mining machinery and vehicles operating continuously during day and night time, but will be dependent on the concentration of the mining activities that is likely to start up in the area.

Ambient air quality and dust levels emitted from the proposed Weltevreden project area must therefore still be monitored on a regular basis to determine potential sources of dust, increases and decreases in dust levels as well as to determine the level of mitigation required. Once the material from the proposed Weltevreden operation area has been mined, processed and decommissioned, overall dust fallout levels will decrease and the cumulative impacts will decrease from a significance rating of medium- low to a low significance.

2.2.11.5 Vegetation

The Grassland biome has the highest biodiversity in South Africa after the Fynbos biome (Driver *et al*, 2004). Mpumalanga falls under the Grassland Biome. The Grassland Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Grasslands are dominated by a single layer of grasses and the amount of cover depends on rainfall and the degree of grazing. Trees are absent, except in a few localised habitats and geophytes are often abundant (Low & Rebelo, 1996).

Agricultural and mining activities in the region have lead to habitat fragmentation (Driver et al 2004) and therefore any further loss of natural habitat is viewed as detrimental to biodiversity functioning in this particular region. The loss of biodiversity leads to ecosystem degradation (Driver et al, 2004) and this study will try to address and identify the species that are found in the area in terms of their Red Data status. The greatest threat to fauna species within this area is the loss of natural habitat, as a direct result of agricultural or mining activities. In an area such as Mpumalanga further habitat loss is critical as bird species are under increasing pressure from mining activities. Mpumalanga accounts for 83% of South Africa's coal production. 90% of South Africa's coal consumption is used for electricity generation and the synthetic fuel industry (http://en.wikipedia.org/wiki/Mpumalanga_Province).

Surface disturbance during the construction of the various mines may appear to be small when compared individually to the total area of the Weltevreden. However, this disturbance needs to be evaluated on a local scale (i.e. within the boundaries of the mine and the local municipalities), regionally (i.e. Mpumalanga) and nationally (i.e. South Africa). A simple method would be to compare the footprint disturbed by a single mine against the local/ regional/ national setting as a percentage. Similarly, the total area disturbed by a particular type of mine or the entire suite of mines could be compared against the local/ regional/ national setting as a percentage.

The areas surrounding the Weltevreden study areas consists of No Natural habitat remaining and Least Concern, in terms of its biodiversity status (Lötter 2007), and mining and agricultural activities are having a negative impacts on the remaining biodiversity in this area.

This study area is currently dominated by maize fields and alien plants infestation. As this will be an open cast mining, all vegetation will be cleared and removed and during the rehabilitation process, indigenous vegetation will be planted. There are no Red Data species present in this area. The significance will be **medium-low** with a scale of **36/100**.

2.2.11.6 Animal life

The loss of biodiversity leads to ecosystem degradation (Driver et al, 2004), and this study will address and identify the species that are found in the area in terms of the Red Data species status. According to Driver et al, 2004, approximately 1.7% of natural areas in Mpumalanga are classified as degraded, with an additional 0.03% of the total area classified as eroded, therefore there is a need to protect and conserve remaining grasslands in that area, and if ignored, then South Africa's biodiverse-rich province of Mpumalanga faces the risk of a further loss of biodiversity. As a result of South Africa's energy crisis and coal mining activities are on the rise in Mpumalanga and the grassland biome is feared to be under threat (Driver et al, 2004). In most parts of Mpumalanga, agricultural activities compete with Coal Mining industries and this will lead in loss of biodiversity in this area of interest. In cases of open cast mining, all the vegetation is removed, and if this trend of open cast mining continuous, there will be less natural vegetation remaining and this will lead to animals moving out of their natural habitats. Mpumalanga accounts for 83% of South Africa's coal production. 90% of South Africa's coal consumption is used for electricity generation and the synthetic fuel industry (http://en.wikipedia.org/wiki/Mpumalanga_Province.

The habitat of the blue crane, which is considered as Vulnerable (Barnes 2000), is open grass fields with low shrubby bushes. It likes wet parts and lays its eggs on the ground. It grazes in the field and eats seeds, insects and small reptiles. During open cast mining, the habitats of these birds will be destroyed and they might be forced to move to other areas. If there are other mining areas next to Weltevreden, this means that these areas will be forced to move out completely to other areas where they can be easily hunted and killed, and this may lead to their extinction in the wild.

In the last two decades, the Blue Crane has largely disappeared from the Eastern Cape, Lesotho, and Swaziland. The population in the northern Free State, KwaZulu-Natal, Limpopo, Gauteng, Mpumalanga and North West Province has declined by up to 90% (http://en.wikipedia.org/wiki/Blue_Crane).

During open cast mining, all vegetation will be removed and this will destroy the natural habitat of mammals and other animals residing in these areas. More time will be required for suitable habitats (of animals that have been chased during operational phase) to be created after the rehabilitation process. The impacts will last beyond closure of the mine and are almost certain to occur. The significance will be **medium-low** with a scale of **36/100**.

2.2.11.7 Avifauna

It has already been mentioned that the study area is situated in the Mpumalanga grasslands, which is of specific importance for numerous species of conservation significance. The Mpumalanga grasslands, especially the escarpment high altitude sour grasslands and their associated wetlands, are under heavy pressure from various commercial land uses e.g. mining, afforestation and agriculture. It is in these areas where the biggest diversity of grassland bird species is concentrated.

Mining activities, especially open cast mines constitutes an unnatural impact on the natural environment in the study area and the region (the potential impacts associated with the mining activity were discussed above and need not be repeated here). Viewed from a broader perspective, it is evident that the study site is located in an area being targeted by numerous mining applications. The agricultural practises in the area have over the years have already lead to some fragmentation and degradation of the natural grasslands and wetlands but fairly large areas of wetland and grassland have still remained intact. If left unchecked, the cumulative effect of all the proposed mining activities in the area could, at a regional scale, have a catastrophic effect on the remaining grassland and wetland habitat. From an ecological perspective, it is therefore critical to assess and, where needed, limit the impacts, in order to conserve the remaining natural environment, especially the wetlands and associated grasslands, as effectively as possible.

The impacts associated with the potential Weltevreden mine, when viewed in isolation, may seem to have a low significance, as the direct impact on Red Data bird species is likely to be minimal. But when viewed cumulatively with various other mining applications that are currently lodged in the Mpumalange highveld and immediate vicinity of the study area e.g. Wonderfontein, North Block Zoekop, Eerstelingsfontein, Kaalplaats, Vogelstruispoort and Paardeplaats, the scenario changes. Due to the nature and interconnectedness of the wetlands and grasslands in the area it is likely that the cumulative effect of several open cast mines in the region could be significant. If numerous wetlands in the area are affected and multiple areas of remaining grassland are lost then the effect of habitat transformation on grassland and wetland bird may well be significant, and may even lead to the disappearance from the Mpumalanga highveld of Red Data species such as Blue Crane, Grey Crowned Crane and Denham's Bustard.

2.2.11.8 Archeologically and cultural heritage sites

Although it is not expected that archaeological sites will be directly affected by the proposed Northern Coal Weltevreden project, various cultural and archaeological sites exist within the regional boundaries of Belfast and Mpumalanga. Archaeological and heritage resources are increasingly being threatened by cumulative impacts of the industrial, agricultural and mining developments and it is important to preserve and raise awareness of the importance of archaeological and heritage conservation. Cumulative impacts of a proposed project such as the proposed Northern Coal Weltevreden project may be capable of adding value if positive contributions are made towards archaeological research and effective documentation and mitigation of relevant heritage sites in the area. Ultimately, the development should aim to minimise or avoid all anticipated negative impacts and optimise positive impacts.

2.2.11.9 Wetlands

The wetland groupings of endorheic pans, seepage and floodplain wetlands were identified as the three main functional wetland groupings in the Mpumalanga Province (DWAF, 2002). The endorheic pans occur predominantly in the wetter highveld region, mainly grassland biome, with the main concentration in the Lake Chrissies area. According to DWAF (2002) a total of 4 628 endorheic pans occur in Mpumalanga of which 2043 are determined to be perennial and 2585 non-perennial pans. The majority of perennial pans are still intact (89.34%) with 10.66% being transformed. The non-perennial pans are more heavily transformed with 31.13% being transformed and 68.84% still intact (DWAF, 2002).

Floodplain wetlands are generally characterized by a broad, generally flat landform, which is generally dominated by alluvial processes, these wetlands can also occur adjacent to a well-defined river channel (DWAF, 2002). It was determined that the majority of floodplain wetlands in Mpumalanga are untransformed (87.29%) and 12.71% are transformed (DWAF, 2002). Seepage wetlands occur predominantly on a noticeable slope and include those areas on sloping valley bottoms and are commonly called seeps or sponges. According to DWAF (2002) the land use impact in Mpumalanga, affects 22.08% of the seepage wetlands and 77.92% are untransformed.

Cultivated lands have a 6.96% impact on floodplain wetlands and a further 12.37% impact on seepage wetlands in the Mpumalanga Province (DWAF, 2002). Drainage of floodplain and seepage wetlands as a result of agriculture has dramatic impacts on their hydrological value and this drainage can be described as the main threat to the integrity of wetlands (DWAF, 2002). Cultivated lands is also a major threat to endorheic pans in Mpumalanga due to fields in crop farming regions often surrounding or encroaching directly onto the periphery of pans, or even impinge into the actual basins of smaller non-perennial pans (DWAF, 2002). More than 70% of the pans in Mpumalanga are affected by farming practices (Allen, Seaman & Kaletja 1995). Mining has a 0.58% impact on floodplain wetlands and a further 0.69% impact on seepage wetlands in the Mpumalanga Province (DWAF, 2002).

Mining operations are widespread in the Mpumalanga highveld coalfields. Associated with coal mines are power stations which require extensive water supplies, which in most cases are imported from the Vaal and Komati rivers (DWAF, 2002). Hence the importance of wetlands to provide sustainable water supplies. Taking into consideration the ecological importance of the Vaalwaterspruit as a tributary to the Komati River, as well as the pan and adjacent wetland areas to provide water to the catchment, protection of these water resources is important. Additionally, the study area is situated in the Grass and Wetlands region of Mpumalanga and with the increase in mining activities in the region, there is an urgent need to protect these systems. According to the Mpumalanga Conservation Plan (Ferrar, 2007) the study area is associated with a river ecosystem determined to be critically endangered. Of Mpumalanga’s 30 river types, 83% are threatened (Ferrar, 2007). Additionally, 33% are critically endangered, 40% are endangered and 10% are vulnerable. According to Ferrar (2007) critically endangered defines these river types to be one for which there are few remaining rivers occurring in healthy sub catchments and for which the rehabilitation of catchments is required. Thus the importance to conserve the water resources associated with the study area. As a result of this, the cumulative loss of wetlands will be of **medium-high** significance.

2.2.11.10 Surface Water

The area is located downstream of the main catchment areas of the Nooitgedacht Dam Catchment (i.e. quaternary catchment X11D) in the Highland Local Municipality. In the vicinity of the proposed area, there are three registered water users abstracting between 300 and 382 000m^3/a for agricultural uses including irrigation and stock watering. It is therefore imperative that the impacts associated with the proposed project be managed to prevent negatively affecting the dams used for abstraction.

Currently the regional water quality (benchmarked against the SANS 241 drinking water standards) indicates that there are no major water quality impacts (except that related to previous mining) in the area, and it is important that the project does not negatively affect this water. Where catchment flows are affected by mining, principles of water use and demand management must be born in mind. The dirty water must be re-used/ recycled or even treated so as to not place a burden on the water demand in the area. The minimization of the quantity cumulative impacts will be linked to the implementation of on-going rehabilitation. This will result in positive impacts when compared to the operational phase of mining. However, it is essential to recognize that the proposed project will not have a reinstate the pre-mining conditions in terms of surface water resources but will result in some alteration of the pre-mining conditions.

Since the area is considered to be water scarce and farmers rely heavily on seasonal rains coal mining as a growing industry may pose a burden on the available water quantity in the area. Coal mining and associated infrastructure may require large quantities of water. It is thus essential that effective mitigation measures are in place, at all mines, to reduce the impact on surface water quantity in the region. Mining also results in the deterioration of water quality and monitoring must be used as a management tool to detect any impacts to water quality so that mitigation can be implemented. Therefore, more effort needs to be undertaken to minimise any negative impacts on the main river flowing through the area. The cumulative impact on water quality will have **medium-high** significance. The cumulative impact on water quantity will have a **high** significance.

2.2.11.11 Groundwater

The cumulative impacts due to the proposed mining could be of a quantitative and qualitative nature. The aquifers within the region are classified as minor aquifer systems and their main function is a domestic water supply source as well as supplying base flow to the surface water environment. This will result in a positive impact locally and could see the importance of groundwater increasing as a potential source within the catchment. However, the water quality within the workings could be good or deteriorate depending on the geochemical characteristics of the material. This could in turn result in surface water users being put under pressure should the decant water quality lead to the deterioration of surface water resources in the catchment. The cumulative impact on the catchment will have to be taken into account for mining, agriculture and the remainder of the current surface and groundwater uses in the Komati River Catchment. It can however be anticipated that the cumulative impacts will have a **high** significance and has a score of **80/100.**

2.2.12 Knowledge gaps and recomendations

2.2.12.1 Wetland delineation

This study did not include a full baseline assessment of the wetlands in the study area but used information generated from other specialist reports to supplement this report. Plant indicator species were used during the study to assist with the delineation.

An ecological assessment of the streams and dams on site was not conducted. Dams are regarded as artificial systems and do not provide an indication of the ecological integrity of the system. Additionally, the River Health Programme (RHP) methodologies described to assess a river/stream were developed for lotic systems (rivers and streams) and are not applicable to lentic ecosystems (dams, lakes, pans etc.). The lentic nature of the study area, combined with low flows and the dams, resulted in no RHP methodologies being implemented.

A soil, land capability and land use assessment was conducted by Rehab Green CC and findings from the survey have been used to supplement the findings from the wetland assessment. According to Rehab Green CC the delineated wetland areas play a very important part in the ecosystem which is already largely disturbed by agricultural activities. The wetland areas function as surface drainage systems, an important habitat and a mechanism to recharge the ground water system as well as open water sources downstream. In conclusion four of the seasonal and permanent wetland zones which form part of drainage lines and are linked to open water sources need to be protected and were excluded from the proposed opencast area. These wetland zones should also be protected by means of a 50m buffer zone.

Given the extent and position of the proposed mining activities in proximity to the wetland areas, it may be assumed that these wetlands areas to the north and east of the study area will be impacted on with some wetland areas being lost completely. With regard to water quantity, the position of the wetland within the larger catchment becomes an important consideration. Mining a wetland downstream of the catchment origin will impact significantly on the water quantity reporting to the system downstream of the mining area, because the water flow from all upstream areas flowing into the wetland in question may be lost due to the disturbance. The proposed mining area is at the origin of the catchment and would therefore be a minor impact in terms of water quantity reporting to wetland systems further downstream as opposed to the mining area being downstream of the catchment origin.

Taking into consideration the position of the proposed mining area within the catchment, it is recommended that direct impacts to the wetland areas be restricted to the proposed opencast areas only and mining activities adhere to the 1:100 year floodlines and described buffer zones. Additionally, the functioning of the wetland areas which will be lost and should be artificially created so as to ensure the survival of the remaining wetland areas and larger system as a whole, ensuring water quality provision and enhancement services continue.

2.2.12.2 Blasting and vibration

To the knowledge of the author there is no immediate concern with regards to shortfall in the information provided. More detailed mine plan may prove to be helpful for further mitigation of ground vibration and airblast. Considering the stage of the project, the data observed was sufficient to conduct an initial study. Surface surroundings change continuously and this should be taken into account prior to any final design and review of this report.

In terms of blasting and ground vibration the following recommendations have been made:

- Pre blast survey of all structures identified surrounding the mining area.
- Ground vibration survey in the form of signature trace study to be done for determination of ground vibration constants that can be used for accurate prediction of ground vibration.
- Design of blasts to ensure safe levels of ground vibration and airblast is maintained,.
- Redesign with alternative diameter blastholes and charge masses to accomplish safe blasting.
- Investigate the possibility of electronic initiation.

2.2.12.3 Surface water

There were only two DWAF water quality monitoring points downstream of the proposed project and thus a differential of upstream to downstream impacts could not be determined. This is most useful to be able to determine the water quality trends up- and downstream of the site as well as to determine any water quality trends that have been existing prior to, during and after the mining operation ceases.

Where this kind of data is available, it can therefore be used as reference water quality data and put into perspective the project related impacts on the downstream users.

2.2.12.4 Groundwater

In the event of the Acid Base Accounting (ABA) not being undertaken the acid neutralisation and acid generating potential will not be knows and worst case scenario will have to be adopted.

2.2.12.5 Fauna

No amphibian survey was completed for Weltevreden and there for there is no indication of species that are present on the proposed project site. It is recommended that an amphibian survey be completed in the wet season before any activities commence.

2.2.12.6 Traffic Study

No full traffic study was undertaken on the routes in which the coal trucks will be travelling to the proposed power stations. It is recommended that a full traffic study is completed before the operation of the mine and those necessary upgrades aspects such as intersections are completed before operation commences

2.3 SECTION 39(3)(B)(II) – SOCIO ECONOMIC

"Investigate, assess and evaluate the impact of his or her proposed prospectiong or mining operations on...... (ii) the socio-economic conditions of any person that maybe directly affected by the propecting or mining operation."

2.3.1 Engagement with Interested and Affected Parties

Details of the engagment process that was followed with I&APs as well as the various Statedepartment is described in section 2.3.1. A complete Public Participation Document is attached as Appendix N.

2.3.2 Assessment of socio-economic impacts

Social impacts can be defined as the consequences of any action that changes the way a community lives, works, relates to one another, organises themselves and functions as individuals and members of society.

Table 56: Socio-economic impacts

Aspect	Phase	Effect/Impact	Significance & Severity (before mitigation)	Mitigatory Measures
Regional & local Socio-Economic Environment	Pre-construction Phase, Construction Phase & Operational Phase	The mine's SLP will be integrated into the Emakhazeni IDP through serving on the local LED Management Committee and assist in implementing LED projects and/or programmes identified in the IDPs, in partnership with local government, business and affected communities.	Positive (medium)	No mitigation required (Enhancement/ optimisation of positive impact i.e. Effective implemetation of LED)
Regional & local Socio-Economic Environment	Construction Phase & Operational Phase	The proposed operation on Weltevreden 381 JT will likely influence development opportunities within the Emakhazeni Local Municipality contributing towards the local economy through the continuation of a number of employment and income generating opportunities for local suppliers and other beneficiaries in the area and a demand for services from nearby towns.	Positive (medium)	No mitigation required (Enhancement/ optimisation of positive impact i.e. Effective implemetation of SLP and LED)
Community and Employees	Construction Phase & Operational Phase	A Sustainable Development (SD) Plan has been prepared by Northern Coal to provide a framework for initiatives that promote the sustainability of employee households, as well as that of the host community, described in more detail in the SLP Report.	Positive (medium)	No mitigation required (Enhancement/ optimisation of positive impact i.e. Effective implemetation of SLP and SD)
Community	Construction Phase & Operational Phase	Northern Coal, in consultation with the Municipality has identified the upgrade of the Umneli Primary School as its LED Project. The mine will be responsible for the upgrade of the current facilities, as well as the purchase of facilities and equipment (i.e. sports and laboratory equipment). The mine will purchase required learning materials.	Positive (medium)	No mitigation required (Enhancement/ optimisation of positive impact i.e. Effective implemetation of LED)
Employees	Construction Phase &	The Weltevreden SLP will seek to improve the conditions of health, nutrition and accommodation of it employees, as required	Positive (medium)	No mitigation required (Enhancement/ optimisation of

Aspect	Phase	Effect/Impact	Significance & Severity (before mitigation)	Mitigatory Measures
	Operational Phase	by the Mining Charter and the MPRDA.		positive impact i.e. Effective implemetation of SLP)
Employees & Community	Construction Phase & Operational Phase	Appropriate levels of Historically Disadvantages South Africans (HDSA) and local procurement will be met from the outset of the operation.	Positive (medium)	No mitigation required (Enhancement/ optimisation of positive impact i.e. Effective implemetation of SLP tagets)
Community	Construction Phase & Operational Phase	There may be a lack of skills and capacity amongst targeted individuals and communities who have been earmarked to benefit from Weltevreden's LED projects. Target communities may be at risk of being bypassed by livelihood and development opportunities that are created, due to vested interests by certain parties involved in the SLP processes.	Negative (medium)	Fair training and employment opportunities must be offered to all affected parties in terms of the relevant SLP and LED processess, followed by effective monitoring and management
Community	Construction Phase & Operational Phase	Opencast mining will have a negative impact on the socio-economic environment by removing cultivated land from active production and by increasing the level of noise and dust in the area.	Negative (medium)	If agricultural land will be directly affected, a full social impact assessment may be required. Dust suppression and noise mitigation measures need to be implemented in terms of the plans described in the EIA/EMP
Economic Viability	Construction Phase, Operational Phase Decommissioning & Closure	The projected annual capital that would be available for Broad Based Black Economic Empowerment via Northern Coal's Trust is 1.5 million per year, for the life of the Weltevreden Mine. The proposed operation will continue for a period of eight years, after which the further viability of the mine will be re-assessed.	Positive (medium)	No mitigation required (Enhancement/ optimisation of positive impact with regards to BEE empowerment targets)
Employees	Decommissioning & Closure	Retrenchment will be necessary during the decommissioning and closure phases.	Negative (medium-high)	Retrenchement processess must be implemented in compliance with relevant legislative requirements and applicable SLP and LED targets, followed by effective monitoring and management

2.3.3 Engagement with interested and affected parties and state departments.

The engagement rocess was undertaken in terms of Section 2.2.8. Socio-economic imacts that wehre raised during the consultation process can be seen in the table below.

Table 57: Socio-economic impacts raised by I&APs

Impacts Raised by I&APs and State Departments		**Related back to Source Activity**	**Proposed Mitigatory measures**	**Phases**
Impacts Raised by I&APs				
Socio-economic	Local recruitment and procurement	• Construction of hydrocarbon storage facilities (including diesel tanks, wash bays and oil/diesel separators and flammable liquid storage) • Construction of offices and change houses • Construction of storm water diversion berms • Operation of portable ablutions • Operation of pollution control dam and storm water management systems • Re-vegetation of disturbed areas • Domestic and industrial waste storage and removal	• Focus employment on local people who are unemployed • Implement the Weltevreden SLP at the outset of the development, prior to the commencement of the construction phase	Construction Operational Decommissioning
Sustainability	The area is better suited for agriculture and tourism activities than it is for mining.	All activities during the construction, operational and decommissioning phases.	As per sustainability impact assessment	As per sustainability impact assessment
Health and Safety	Commuting of construction workers onto adjacent	Construction, operational decommissioning	The commuting of construction workers onto adjacent properties is prohibited	Construction, operational and decommissioning

Impacts Raised by I&APs and State Departments		Related back to Source Activity	Proposed Mitigatory measures	Phases
	properties may pose health and safety risks	activities	and should be monitored.	phases
Skills development	Provision of skills to unemployed community members to allow for opportunity to work at the mine	Construction, operational and decommissioning activities.	Implement the Weltevreden SLP at the outset of the development, prior to the commencement of the construction phase	Construction, operational and decommissioning phases
Archaeology	Impacts of construction and mining activities on features/sites of archaeological/ cultural significance.	Construction, operational and decommissioning activities.	As per the archaeological impact assessment	As per the archaeological impact assessment
Impacts Raised by State Departments				
Emakhazeni Local Municipality				
Socio-economic	Local recruitment and procurement	Construction, operational decommissioning activities	• Focus employment on local people who are unemployed • Implement the Weltevreden SLP at the outset of the development, prior to the commencement of the construction phase	Construction, operational and decommissioning phases

2.3.4 Assessment of environmental impacts resulting from identified alternative land use and developments

2.3.4.1 Identified alternative land use and developments

Commercial agriculture

Weltevreden is currently been used for commercial maize farming. Commercial crop farming and grazing are the main agricultural practices in the area. This would therefore be the main alternative land use for the Weltevreden project area.

Potential impacts

Commercial agriculture is high intensive and requires resources such as good soil nutrients and sufficient water availability for irrigation. In many cases commercial agriculture requires a high input of fertilizer, pesticides and water in order to produce high yields. Intense agricultural farming can result in environmental degradation. Associated environmental impacts of commercial agriculture can be the following:

- Biodiversity loss:
    - Loss and degradation of habitat from clearing of grasslands and draining of wetlands;
    - Reduction of fish stock in rivers as a result of pesticide runoff;
    - Killing of wild predators in order to protect livestock; and
    - Loss of genetic diversity with replacing wild strains with monoculture strains.
- Soil:
    - Erosion;
    - Loss of fertility;
    - Salinization; and
    - Water logging.
- Air pollution:
    - Dust generation during harvesting and ploughing of lands;
    - Air pollution in the event of slash and burn; and
    - Air pollutants from the use of fossil fuels during use of machinery.
- Water

- Aquifer depletion:
  - Increase runoff as a result of cleared vegetation;
  - Sedimentation;
  - Surface water pollution from pesticides and fertilizers; and
  - Over fertilization of slow moving streams as a result of runoff of nitrates and phosphates from fertilisers and livestock waste.

Potential cumulative impacts

The Weltevreden project area would only be suitable for small scale commercial agriculture which would therefore result in the potential impacts being of low to medium significance. However, taking into consideration that the areas surrounding the proposed project area are also used for agricultural purposes this will increase the likelihood of the above mentioned potential impacts occurring and will increase the significance of these impacts. In the event of land degradation occurring throughout the area, it will result in the loss of land suitable for agriculture and worst case scenario will result in desertification. Good agricultural practices throughout a region are therefore vital together with a polyculture approach to minimise the cumulative impacts.

Commercial agriculture also has positive impacts as it provides food produce for the Nation. Depending on the food produce it may also allow for export and therefore bring in foreign exchange. Agricultural activities also create employment in an area.

The choice of commercial agriculture as an alternative land use may be jeopardised by the costs of inputs and market price of produce, natural environmental risks and due to land transformation. However, it is important to encourage sustainable commercial farming in order to support our ever dwindling food per capita ratio.

2.3.5 Cherry farming (non organic)

The feasibility on the use of the proposed mining site for cherry farming will depend on the market. Cherry farming requires initial capital expenditure as it takes 3-5 years to bear fruit. Orchards will require both fertilisation and pesticides. The soil must be tested before any fertiliser can be applied. Farmers growing cherry trees on fertile soil usually require only nitrogen fertiliser. The method normally used on application of fertiliser is the broad band method. The application must be about 30 cm from the trunk to the drip of the branches. Fertilisers can also be injected through irrigation systems (broadcast). A disease and insect control programme is essential to ensure productivity and high fruit quality. Brown rot and powdery mildew are the most frequent serious diseases. Bacterial canker is one of the major bacterial diseases. Pests that normally attack the cherries are apple maggot and plum curculio. Apple maggots lay eggs on the fruit and plum curculio feeds on flower and later on the fruit. Peach bore lays eggs on twigs, leaves or on fruit and can be controlled biologically and by the use of pesticides. Birds can be controlled by using bird netting after fruit set. Weeds compete with the trees for water and nutrients. Competition from weeds can be a major problem for young trees.

The cost of producing cherries is substantially increased by the need to cover orchards for both rain and hail. Hail nets are erected at the time of planting to protect the leaves from destruction. Nets tilted to the west are often coloured black to help screen the intense sunlight. As trees mature, rain covers are positioned to protect the fruit. Cherry trees are sensitive and venerable to changes in climate conditions. Early frosts could damage blooms present.

If the cherries are to be exported to the United Kingdom there are six separate inspection programmes which will be at an annual fee to the grower. Cherry farming does provide employment especially during picking.

South African cherries look very promising. Competition free markets, high grower returns and inexpensive labour could mean high profits for South African growers.

Potential impacts

Cherry orchards will make use of pesticides, fertilisation which will lead to water and soil pollution furthermore existing vegetation will need to be removed in order to prepare the land and plant the orchards. The implementation of systems like drip irrigation can however reduce the potential for surface runoff and water logging as it increases water efficiency by 90% and reduces water use by 37 to 70%.

There will be loss of natural vegetation during the clearing of the areas for the orchards. The nets covering the orchards will have a visual impact.

2.3.6 Community agricultural practices

Community agriculture is normally characterised by subsistence farming of monoculture crop farming and grazing. In the majority of instances, subsistence agriculture achieves less than half of maximum achievable yield. Such a land use will require long term inputs of land management, resources and education from an external source to achieve a sustainable community agricultural project which will not only provide a food source but will also provide an income. For the establishment of a sustainable rangeland for grazing the carrying capacity of the site will need to be determined and this cannot be exceeded.

Potential impacts

Community agriculture can easily result in various environmental impacts such as erosion, land degradation, and overgrazing as the nomadic herding has been reduced as a result of various factors.

Cumulative impacts

In the event that the surrounding areas are allocated for community agriculture it may intensify the loss of agricultural potential through bad land management. It may allow for a greater area to be allocated for grazing and may result in reduced likelihood of overgrazing. However the greater area will also have a carrying capacity which if exceeded will result in overgrazing.

Community agriculture can have a positive impact through the upliftment of communities. It also needs to be considered that people within communities are being pushed from rural areas to urban areas by factors such as poverty, lack of available land, and decreasing agricultural jobs due to increased mechanisation. They are also been pulled to the urban areas in search of a better way of life, and jobs.

2.3.7 Tourism

The Belfast area forms part of the earmarked "Trout Triangle" of Mpumalanga. This is said to be one of the best Trout areas in Mpumalanga. The development of the Belfast dam, Dullstroom dam, a Fly-fishing park in Machadodorp and further development of the

Elandskrans resort in Waterval-Boven hold tremendous potential for the region and could have positive spin-offs for the area as a whole.

Guest houses, eco-lodges, trout fishing and other recreational activities that promote the local biodiversity and cultural history of all forms part of tourism. It is important to manage these activities properly in order to prevent negative impacts from occurring on the natural environment. Possible recreational activities that could occur in the area include hiking, bird watching, cycling, and 4x4 trails.

If tourism activities are properly managed then the impacts on the environment are less intensive. Tourism is thus an attractive alternative for development. It is important that regional planning and infrastructure development takes place before tourism activities commence to ensure a successful venture. Local communities can be uplifted through tourism and significant heritage sites can be preserved through tourism.

Potential impacts

Negative impacts that could result from tourism include the introduction of alien fauna and flora (e.g. trout into rivers for fishing) as well as the over utilisation of natural resources such as water. It is important to properly plan activities that could result in a nuisance factor like quad biking.

Tourism could make a major contribution to the local economy of an area with minimal disturbance to the environment if managed properly.

Cumulative impacts

The cumulative impacts of tourism are minimal and generally positive provided that it is properly managed. It could also promote the development of the natural cultural diversity of the area and help to develop the local economy. The income generated from tourism is not as much as from agriculture or mining but it is more sustainable over the long term. Tourism could also impact cumulatively on the social environment if the local communities are also involved in the activities.

2.3.7.1 Summary of alternative land uses

From the above mentioned possible land use alternatives, tourism will likely have the least impact on the receiving environment, however this will be dependent on the associated activities. Cherry farming, especially if organic practices are followed is likely to be the second most suitable alternative land use when considering environmental impacts. However when compared to mining, agriculture will be a preferred land use as it will have a less of a significant impact on the receiving environment in comparison that to mining.

2.3.7.2 Comparative impact assessment

The table below is a summary of the alternative land uses, and their potential impacts.

Aspect	Land use impact on the environment				
	Agriculture	**Cherry farming**	**Community agriculture**	**Tourism**	**Mining**
Topography	Negligible or no impact. Low significance	Negligible or no impact. Low significance	Negligible or no impact. Low significance	Negligible or no impact .Low significance	Temporary impact during mining. Potential for bulking effect at closure. Medium-high significance
Geology	No impact. Low significance	No impact. Low significance	No impact. Low significance	No impact. Low significance	Geology will be removed in order to mine the coal deposit. High significance
Soils	Grazing and crop farming practices could result in compaction of soil, reduction in soil fertility through poor crop management as well as loss of soil through erosion. Alteration of soil properties through fertilisation Medium-high significance	Minimal disturbance will occur during planting of the orchards. Minimal fertilisation is required. Low significance	Community based agriculture can have significant impact on soil structure and fertility as a result of poor land management such as crop rotation and over grazing. Poor agricultural practices can also result in loss of soil through erosion. Medium-high significance	Tourism facilities may cause soil compaction and soil erosion (e.g. from activities such as quad biking) Medium-low significance	Negative impact on soil fertility from storage and erosion. Impact on soil quality from hydrocarbons storage and AMD. High significance
Surface water	Water quality could be affected through fertilisers, soil and animal waste that wash into local streams. Stock watering and irrigation will also impact	Surface runoff from irrigation could potentially impact surface water. Low significance	Water quality could be affected through fertilisers, soil and animal waste that wash into local streams. Stock watering and irrigation will also impact	Limited impacts. If dams are constructed or additional lodges built it would impact on water courses.	Local resources could be contaminated from oxidation of coal. Water required for operations will also impact on resources.

Aspect	Land use impact on the environment				
	Agriculture	**Cherry farming**	**Community agriculture**	**Tourism**	**Mining**
	on water resources. Medium-low significant		on water resources. Medium-low significant	Low significance	High significance
Groundwater	Fertilisers and animal waste entering groundwater resources. Abstraction for stock watering and irrigation will also impact resources. Medium-low significance	Abstraction of water for irrigation purposes. Medium-low significance	Limited impacts as irrigation and fertiliser use will be minimal. Low significance	Limited impacts. Domestic waste/effluent and chemical compounds could enter groundwater. Abstraction for use to run tourism facilities. Low-significance	Oxidation of coal will lead to contamination of groundwater resources. Abstraction of water will impact on local aquifers and surrounding water users. Medium-high significance
Land capability	Poor grazing and farming practices may decrease land capability through erosion and nutrient reduction. Medium-low significance	Minimal impact to land capability will occur. Low significance	Poor grazing and farming practices may decrease land capability through erosion and nutrient reduction. Medium-low significance	Preferred land capability for tourism is wilderness, thus loss of potential agricultural land or mineral reserves. Low significance	Reduction in land capability. Medium-high significance
Land use	Land use will not change since it is currently agricultural. Low significance	Land use will not change since it is currently agricultural. Low significance	The current land use is agriculture; however community agriculture is undertaken on a smaller less intensive scale then commercial agriculture. Low significance	Tourism will result in a change of land use. It would be positive in terms of sustainability but negative in terms of loss of agricultural and mining potential. Low significance	Land use will change during opencast mining operations. Medium-low significance
Air quality	Ploughing/harvesting and movement of livestock will	Negligible impact	Impact on air quality will depend on available	Negligible impact	Increase in dust levels from mining activities and

Aspect	Land use impact on the environment				
	Agriculture	**Cherry farming**	**Community agriculture**	**Tourism**	**Mining**
	increase dust levels. Medium-low significance	Low significance	equipment to the community. It is not likely that automotive equipment will be available for ploughing/harvesting. Low significance	Low significance	transportation of coal. Medium-low significance
Noise	Localised noise generation from farming equipment. Low significance	Minimal noise will be generated. Low significance	Minimal noise will be generated. Low significance	Potential for noise generated from quad bikes, hunting and clay pidgin shooting. The impact will be localised. Medium-low significance	Sporadic increase in noise from blasting activities. Machinery and trucks will also contribute to a localised increase in noise levels. Medium-low significance
Fauna	Expansion of farming activities will result in further reduction of habitat which will cause a decrease in the local fauna. Medium-low significance	Orchards will be netted which will restrict the movement of animals. Vegetation will also need to be removed for the development of the orchid which will result in the loss of habitat Medium-low significance	The area is already used for commercial agriculture. A reduction in scale may encourage natural vegetation growth and therefore increasing favourable habitats. Low significance	Generally increased preservation of habitat and thus fauna e.g. game farms. Negative impact if invasive species are introduced e.g. trout. Low significance	Animals living on site will move away due to the increase in movement and noise on the site as well as the loss of habitat. Medium-low significance
Flora	Expansion of farming activities will reduce the indigenous plant species due to grazing/lands. Medium-low significance	Vegetation will need to be removed for the development of the orchid. All vegetation growing between the trees will also be controlled in order to	The area is already used for commercial agriculture. A reduction in scale may encourage natural vegetation growth.	Generally preservation of flora occurs with tourism e.g. game farm. Low significance Negative if the local flora is removed e.g. golf	While mining is taking place there will be a reduction in flora on site. This should go back to pre-mining status once rehabilitation is completed.

Aspect	Land use impact on the environment				
	Agriculture	**Cherry farming**	**Community agriculture**	**Tourism**	**Mining**
		minimise competition for resources. Medium-low significance	Low significance	courses. Medium-low significance	Medium-low significance
Sites of archaeological and cultural interest	Impact will be negative if no archaeological assessment was done pre-agriculture. Sites are often destroyed from ploughing fields and overgrazing. Low significance	Archaeology sites could be destroyed through the development of the orchid. Low significance	Impact will be negative if no archaeological assessment was done pre-agriculture. Sites are often destroyed from ploughing fields and overgrazing. Low significance	Positive impacts since tourism activities usually preserve archaeological and cultural sites. Low significance	Archaeological sites can be preserved if an Archaeological impact assessment was conducted prior to mining. Opencast mining will remove all potential sites below the soil. Low significance
Visual aspects	Large buildings associated with agriculture e.g. grain silos will have a localised visual impact. Low significance	Nets protecting orchards will have a visual impact. Medium-low significance	Negligible impact. Low significance	Negligible impact. Any structures constructed usually conform to the surrounding landscape Low significance	Opencast mining will have a negative visual impact on the area. The dust created during mining as well as the machinery will also contribute to the impact. Medium-high significance
Traffic and safety	Negligible impact. Low significance	Negligible impact. Low significance	Negligible impact Low significance	Increase in traffic and possible increase in accidents. Low significance	Increase in vehicles and heavy machinery could lead to an increase in road and pedestrian accidents. Medium-high significance

Aspect	Land use impact on the environment				
	Agriculture	**Cherry farming**	**Community agriculture**	**Tourism**	**Mining**
Regional socio-economic structure	The land is currently used for commercial farming so no change is expected. Limited employment and skills development. Positive impact Medium-low significance	Cherry farming will employ minimal permanent employees but will provide seasonal work during the picking season. Positive impact Medium-low significance	Community agricultural is undertaken on a subsistence level that will only benefit the family or community Positive impact Low significance	Positive impact through creation of employment opportunities with tourism facilities and training/education. Positive impact Medium-low significance	Increase in employment opportunities and skills development. Social upliftment of the area will also occur. Positive impact Medium-high significance

2.3.7.3 Possible land uses after mining

After the EIA/EMP feedback meeting, it was decided to consult an agricultural economist regarding the potential sustainable development options post-mining. Constructive recommendations and was subsequently obtained input from Murray Clarke from EJC Solutions and the following advice was proposed regarding post-mining land use. In light of the climate found in the area concerned, there are several possibilities for future crops.

Maize & Soya, a return to the growing of maize and soya is the most likely land use post mine as it is known by the workforce and the owner. The land lends itself to these crops. There would be no need on the farmer's part to invest money to this enterprise (over and above the cost of the inputs, seed fertiliser and chemical controls) though an increase in fertiliser maybe required to improve initial fertility post rehabilitation.

Livestock, as with the above, livestock could be returned to the land in question with little or no extra investment (over and above the cost of the livestock)

Cherries: There is a cherry farm near by which indicates that this crop would grow well in the area (climatic data underlines this theory). However, cherry production is a high set up cost, high return business. (comparative figures are provided in Appendix M) With this enterprise, a high level of training would be required for the workforce and expertise would possibly have to be found from outside the area (consultants, managers and other specialists). The period of time from planting cherry trees to full production is around seven years though low levels of production are achieved in the fourth season after planting with new varieties that are available. Various crop protection measures would need to be undertaken due to the summer climate in the area of heavy rains and potential hail storms. It should be noted that training could be undertaken during the lifetime of the mine meaning that the workforce could be ready when planting begins. To mitigate the high set up costs and assist with cash flow during the development phase it would also be possible to grow strawberries

Strawberries: Similar to cherries, the climate lends itself to this crop as well and subject to suitable availability of irrigation resources this crop could quite easily be raised in the area. The climate would make it a complimentary area to the traditional Brits area and the season would be extended and allow local production for the Johannesburg/Pretoria market in competition to the imported fruit normally found there.

The possible advantage from growing the latter set of crops (cherry and strawberries) is that some of the topsoil can be replaced in raised beds (limiting compaction), which are required for this type of production. Raised beds allow for better root development and reduce the instances of root rots and increase the speed of drainage in the root zone following heavy rainfall. The use of the raised beds will also reduce soil erosion as a plastic mulch or grass (depending upon whether strawberries or cherries) will be used to anchor the soil in place. The raised beds, by definition, will also reduce the area of flat land that promotes wind erosion of soil.

As previously stated, the cost of such a crop to set up is high and the management levels required in contrast to Maize or soya are significantly higher. In Appendix A of this report, figures have been attached for the establishment and running of an area of a 75 ha development of the two fruit crops as an indication. It should be noted that the labour requirements of these crops are significantly higher than for a similar area of maize, soya or livestock production. The returns are also significantly higher.

Investment in the above will be extremely high and obviously reliant on a grower or growing company wishing to invest the sums required. It is a specialist form of growing and may not be suitable for this situation due to the above. The upliftment of the area in terms of increased employment and skills training relating to such a project would be high.

It is unlikely that vegetable framing could be carried out in this area despite the similarly high demand for labour to strawberries or cherries due to the climate, the season would be late and short and therefore the competition with other vegetable areas would probably be too high and therefore the enterprise would, more than likely, be unprofitable.

2.4 SECTION 39(3)(B)(III) – NATIONAL HERITAGE

"Investigate, assess and evaluate the impact of his or her proposed prospectiong or mining operations on...... (iii) any national estate refered to in section 3(2) of the National

Heritaage Resource Act (Act No.25 of 1999), with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of the Act"

2.4.1 Engagement with Interested and Affected Parties

Details of the engagment process that was followed with I&APs as well as the various Statedepartment is described in section 2.3.1. A complete Public Participation Document is attached as Appendix N.

2.4.2 Assessment of National Heritage impacts

No sites of heritage significance were found on site. There is from a Heritage point of view no reason why the development can not commence.

If during construction any possible finds are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find.

2.4.3 Knowledge gaps

Due to the nature of cultural remains that occur, in most cases, below surface, the possibility remains that some cultural remains may not have been discovered during the survey. Although PGS surveyed the area as thorough as possible, it is incumbent upon the developer to inform the relevant heritage agency should further cultural remains be unearthed or laid open during the process of development.

2.5 SECTION 39(3)(C) – ENVIROMENTAL AWARENESS

“ Develop an enviromental awarness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risk must be dealt with in order to avoid pollution or degridation of the environment..”

2.5.1 Communication strategy

The communication of the environmental risks for each phase of the project will take place for the management, administrative and mine worker sectors of the mine.

2.5.2 Management sector

A workshop will be conducted to inform all mine management of the risks associated with the mining operation. The risks for all aspects will be explained and the appropriate management options discussed. The workshop will also elaborate on the process of evaluation with regard to data and actions on the mine. The evaluation process is integral in the assurance that the mine reduces any possible environmental risks due to the operation.

The workshop will be conducted prior to the construction phase to ensure that all risks are discussed before there is any chance of the impacts occurring. The workshop may be repeated at certain stages within the life of the project, in the case of new employees etc.

2.5.3 Administrative sector

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

Firstly each aspect will be described, as shown in Table 58 as well as their significance. Risks associated with each aspect will be discussed to ensure that an understanding of how each action of the project may impact on the environment.

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

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

2.5.4 Mine workers sector

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

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

As a method of gaining an understanding of the relevant risks, a play or industrial theatre will be performed and the employees will be encouraged to rehearse and act out a play of their own. These workshops will be conducted in English as well as one of the local languages.

2.5.5 Evaluation of the environmental awareness plan

The evaluation of the Environmental Awareness Plan will be conducted by the management of the mine. This evaluation will entail the auditing of the operation in both the construction and operation phase once activity has commenced.

The Environmental Awareness Plan described above is sufficient to make all those involved with the project aware of those risks that may occur as well as the necessary mitigation required to minimise these risks. This awareness plan displays that Northern Coal is serious about the environment's well being, empowerment of the local people and returning the land to the appropriate use in the future. Environmental issues will be highlighted at monthly meeting scheduled at the mine

Table 58: Environmental awareness plan for Weltevreden mining operation

Phase	Aspect	Environmental Risk	Communication Strategy				Mitigation Activity
			Management	Administration	Mine workers	Contractors	
Construction Phase	Soil	Increase in soil erosion	Workshop	Course	Induction	Induction	Rehabilitate the area as soon as possible. Stockpile soil in the correct manner.
	Animals	Disturbance					Workers must be educated on animal species. Report any rare or endangered species.
	Vegetation	Damage					Limit the area of disturbance to local flora.
	Surface % Groundwater	Contamination & waste					Contain hydrocarbons, limit water use and recycle where possible.
Operational Phase	Soil	Loss of structure and fertility. Contamination of soils. Loss of soil through erosion.	Workshop	Course	Induction & Monthly Meetings	Induction & Monthly Meetings	Stockpiled to height of less than 2 m and vegetated. Hydrocarbon spill kit kept on site and rehabilitation area designated. Areas of erosion reported on a monthly basis and rehabilitated.
	Animals	Habitat loss Fire Hazard					Remediation of the soil and re-vegetation will restore animal habitat. Hunting and trapping prohibited on the mine property. Open fires will be prohibited on the property.
	Vegetation	Removal of vegetation Invader species					Red Data species reported to Mpumalanga Parks Board. Invader species will be eradicated on site. Areas will be re-vegetated after the cut is rehabilitated.
	Surface water	Contaminated runoff from the mining property					All contaminated water to be stored and treated on site before being returned to the catchment.
	Groundwater	Acid mine drainage could cause contamination. Potential to de-water natural springs.	Workshop	Course	Induction & Monthly Meetings	Induction & Monthly Meetings	Precautions will be implemented to prevent acid-mine drainage. Water ingress into the pits will be prevented to limit AMD.
	Air quality	Dust generation by blasting and coal trucks					Dust will be suppressed by water cart on the haul roads and in the pit.
	Sensitive Landscapes	Pollution of watercourses Degradation of wetlands and pans					Pollution control measures are designed for a 1:50 year flood event. An event in excess of this will lead to a dilution of the potential contamination and overflow will be discharged along natural drainage paths. Any accidental spillages will be handled in accordance with the Emergency Action & Response Plan A buffer zone will be established around pans and wetlands.
Decommissioning Phase	Soil	Lack of soil fertility	Workshop	Course	Induction	Induction	Fertilisation programmes will be introduced.
	Vegetation	Alien Species					Remove alien species & plant only indigenous vegetation.
	Surface water	Acid mine drainage – Decrease quality of the water source/s	Workshop	Course	Induction	Induction	Monitoring of water sources
	Groundwater	Acid mine drainage – Contamination of aquifers					Monitoring of water sources

2.6 SECTION 39(3)(D) – ENVIRONMENTAL MANAGMENT PLAN

"Describe the manner inwhich he or she inteds to ... (i) modefy, remedy, control, or stop any action, activity or process which causes pollution or environmental degredation; (ii)contain or remedy the causes of pollution or degredation and mitigation of pollutants, and comply with any prescribed waste standard or management standards or practices."

2.6.1 Environmental objectives

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

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

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

In terms of specific environmental aspects the environmental objectives and goals are briefly summarised below which are applicable through the LOM:

2.6.1.1 Topography

- To manage surface water on site in order to separate clean and dirty water;
- To rehabilitate the area to be free draining after completion of mining; and
- To ensure natural drainage lines are restored.

2.6.1.2 Geology

No specific primary objectives exist with regards to geology; secondary objectives are addressed under the sections for topography, air quality and groundwater.

2.6.1.3 Soils

- To ensure soil is handled during opencast mining operations to allow sufficient material of a good quality to be available for rehabilitation post closure;
- To prevent losing soil quality through mixing of horizons;
- To prevent any soil loss through erosion and through mobilising soils;
- To prevent loss of soil quality through contamination with other substances such as hydrocarbons;
- To prevent loss of soil structure through compacting of soil;
- To prevent loss of soil fertility; and
- To prevent water logging of any soils in the area.

2.6.1.4 Surface water

- To allow the maximum volume of clean drainage of the mining area; and
- To prevent negative impacts on water quality.

2.6.1.5 Groundwater

- The flooding of the opencast pit floor needs to be ensured;
- The placement of material with a high AMD risk below the final water table to be established at closure; and
- The monitoring of the qualitative impacts needs to continue to ensure that the system behaves as predicted.

2.6.1.6 Land capability

- To preserve soil and associated land capability class;

- To regain land capability (grazing and arable) in the area as far as possible after mining; and
- To rehabilitate the opencast area in line with the guidelines for the rehabilitation of mined land (Chamber of Mines and Coaltech, 2007).

2.6.1.7 Land use

- To preserve soil and associated land use potential; and
- To regain land use in the area as far as possible after mining.

2.6.1.8 Air quality

- To reduce dust emissions from the dismantling of equipment and structures as much as possible;
- To rehabilitate all areas of dust generation on site; and
- To monitor dust levels in the area and on site.

2.6.1.9 Noise

- To reduce noise levels at the source as far as possible; and
- To reduce noise annoyance to the surrounding community as far as possible.

2.6.1.10 Natural vegetation / plant life

- To rehabilitate all mined out areas, and re-vegetate these with recommended mixtures of grasses. Red Data Status species removed prior to the clearing of mining areas and conserved within a nursery or protected piece of land can also be replanted within these rehabilitated areas;
- To prevent any contamination or damage to any wetland in the surrounding area;
- To re-vegetate areas in which erosion could occur; and
- To prevent alien and invader species from establishing and spreading to rehabilitated areas.

2.6.1.11 Animal life

- To monitor the species richness and biodiversity of all mammals, birds, reptiles, amphibians and invertebrates on at least a biannual basis within all the rehabilitated areas to determine the improvement of species richness and the success of rehabilitation;
- To minimise the disturbance of animal life and encourage the return of invertebrates, birds, amphibians, reptiles and mammals after rehabilitation;
- Not to alienate the wildlife in the area or to harm any animal life found on the property;
- To prevent the unnecessary destruction of natural habitat and animal life within the boundaries and adjacent areas; and
- To prevent animals being killed by speeding trucks, hunting of any kind by any worker, contractor or visitors to the opencast mine.

2.6.1.12 Sites of archaeological and cultural interest

- To protect archaeological paleontological, cultural and geological resources from the adverse impacts of project related activities;
- To manage and monitor activities during construction, operational and decommissioning phases;
- To promote the overall conservation of natural and cultural resources;
- To prevent damage to items of archaeological, paleontological and geological significance as result of earthworks undertaken as part of construction, operation, maintenance, inspections in the proposed project;
- To avoid looting and/or unauthorised excavation of archaeological resources; and
- To prevent contamination of items of archaeological paleontological and geological significance as result of pollution e.g. oil spills.

2.6.1.13 Sensitive landscapes

- To retain water flow in sensitive wetland areas;
- To retain water quality of wetland areas;
- To prevent silt deposition in wetland areas;
- To preserve wetland habitat and biodiversity;
- To protect Red Data, endemic and protected plant and animal species; and
- To rehabilitate any damaged water bodies to a state as close to the original as is possible.

2.6.1.14 Visual aspects

- To enhance the visual aspect of the site.

2.6.1.15 Traffic and Safety

- To ensure the safety of all road users with the haulage of coal between the mini pit and Mimosa colliery; and
- To ensure sustainable use of the haul road as future access road.

2.6.1.16 Hazardous waste prevention and minimisation

- To reduce the amount of hazardous waste disposed of in the environment by avoiding or reducing waste generation at source;
- To save money by reducing waste treatment and disposal costs;
- Meet national waste minimisation goals; and
- To protect man and the environment, and reduce potential environmental liabilities.

2.6.1.17 Socio-economic objectives and goals

The following socio-economic objectives should be attained during the construction, operation, and decommissioning phases of the Weltevreden project.

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

2.6.1.18 Historical and cultural aspects

Even though no sites of historical and cultural significance are located on the Weltevreden project area, the following objectives to be met during mining are:

- To instil a sense of value in the local inhabitants for the relevant artefacts and structures by the treatment afforded to them by the mining operation;
- To ensure that relocation is done in such a way to retain the relevant context of the artefacts and structures; and
- To encourage the preservation of artefacts not affected by mining.

2.6.2 Management of identified impacts

The ultimate goal of Environmental Management is to:

- Promote economic development while not adversely impairing the environment for present and future generations; and
- Ensure that actions taken by the present generation are not detrimental to the health, wellbeing and economic opportunities of future generations.

2.6.2.1 Organisational Commitment

The success of an EMP is dependent upon the commitment of the organisation, at all levels, to environmental excellence (EPA, 1995). Commitment to structured and effective EMPs will benefit both the organisation's business success and the local communities. This commitment requires that the organisation provides the necessary resources for employee training, reference material and reporting and response procedures.

Senior executives and line managers will be held responsible and accountable for the health and safety of personnel while on duty, as well as the environmental impacts caused by mining activities. The competence of the workforce will be ensured through selection, training and awareness in health, safety and environmental matters. Continuous evaluation measures must be implemented to ensure that performances with regard to social, health and well-being are improved and environmental management is effectively implemented throughout the lifespan of the proposed project. Regular reviews of the company's performance are necessary during and after operations to ensure that procedures are appropriate and to ensure the desired environmental outcomes are being achieved.

2.6.2.2 Environmental management plan

The EMP has been described according to the project activities in order to provide an understanding of what objectives and recommended management measures are required to minimise the environmental, socio-economic and cultural/heritage impact arising from these activities. To facilitate implementation and compliance auditing, the EMP has been separated into the various project phases.

Construction Phase

				Construction Phase								
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency / Duration	Significance Rating		Financial Plan for Monitoring	
No	Description		Affected environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent (per annum)	Final(LoM)
1	Removal of topsoil	1.11	Topography	Removal of topsoil and weathered material from construction areas results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-high	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate sections.							
		1.1	Soils	Loss of the original spatial distribution of soil types and natural soil horizon sequences.	• The areas to be stripped will be restricted to the areas of disturbance as show in the conceptual mine plan (Plan 3).	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-high	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		1.2	Soils	Loss of soil fertility, original soil depth and volume, as well as natural soil functioning.	• Different soil types and horizons should be stripped up to the recommended depth and stockpiled separately for use during rehabilitation according to the soil utilisation guide, Plan 20, Section 16.6 of EIA Report. • Topsoil stockpile heights and slopes need to be indicated to prevent erosion. • Topsoil stockpiles must not exceed a height of 3m and a slope of 1:3 (18.5 degrees from the horizontal). Initial topsoil stockpiled must be used in rehabilitation as soon as possible. All topsoil stockpiles must be vegetated as	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-low	Dependent on number and size of topsoil stockpiles, however, a cost of R 15.25/m3 has been estimated for vegetation	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					soon as possible to prevent loss of resource. • Topsoil must only be used for rehabilitation purposes.						
		1.3	Soils	Compaction of soil due to movement of heavy construction vehicles.	• Construction vehicles will be restricted to areas for topsoil stripping. • Topsoil stockpiles must be protected from vehicle movement that may result in compaction and loss of soil structure.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-low	No additional cost	
		1.4	Land capability	Land capability will be reduced in areas stripped of topsoil, due to loss of soil	• During construction soils that are stripped must be stockpile according to horizon. • Topsoil must be stockpile separately	Engineer and environmental co-ordinator	Construction until closure	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				fertility, original soil depth and volume, as well as natural soil functioning and soil compaction.	for final rehabilitation purposes. • Stockpiles should be vegetated to minimize soil loss. • Topsoil stockpile heights and slopes need to be indicated to prevent erosion. • Topsoil stockpiles must not exceed a height of 3m and a slope of 1:3. Initial topsoil stockpiled must be used in rehabilitation as soon as possible. • All topsoil stockpiles must be vegetated as soon as possible to prevent loss of resource. • Topsoil must only be used for rehabilitation purposes.						

				Construction Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency / Duration	Significance Rating		Financial Plan for Monitoring	
No	Description		Affected environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent (per annum)	Final(LoM)
		1.5	Land use	Change of current land uses to mining. Very severe in areas occupied by agriculture.	• The areas of disturbance will be restricted in accordance with the conceptual mine plan, Plan 3.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-low	No additional cost	
		1.6	Sensitive landscape (Wetlands)	Sedimentation of the water resources due to erosion of the overburden during periods of high rainfall. Topsoil and overburden stripping and vegetation removal reduces recharge of shallow	• Removal of vegetation during stripping and construction activities will be minimized to reduce the erosion potential and footprint of disturbed area. • Topsoil will only be removed off areas proposed for immediate mining. Wetland soils of soil types Ka and Lo1 should be separated and stored correctly for rehab efforts.	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				aquifers that feed hillslope wetlands, reducing flow in water resources. This activity will increase the erosion potential of the area.	• Disturbance to vegetation and sensitive landscapes will be restricted to the conceptual mine plan, Plan 3.						
		1.7	Air Quality	The stripping of topsoil, exposing subsoil will impact on the dust fallout levels as well as the PM10 levels	• The removal of vegetation will be minimized during stripping to reduce the effects of dust pollution as a result of exposed soil. Dust suppression must take place. • Dust monitoring must be undertaken in accordance to the monitoring programme provided in Section 16 of the	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-low	Medium-low	R75 000	R525 000

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					EIA Report. T • opsoil stockpiles for more than two days should be kept moist and topsoil stock piles for more than a year should be planted and water to sustain biological components as well as prevent dust emissions. • Cover all trucks hauling soil. T • he limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m^3						
		1.8	Noise	Construction activities, including the	• Noise barriers must be constructed to attenuate noise levels in the form of berms	Engineer and environmental co-	Throughout construction phase	Medium-low	Low	No additional cost	

				Construction Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				movement of machines will affect noise levels in the area negatively	around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 1.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Construction activities will be limited to daytime hours. Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.	ordinator. Contractor					

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(Lo M)**
		1.12	Visual	The removal of soil from the construction area will result in the alteration of the project site and thus a probable visual disturbance.	• The areas of vegetation removal and stripping will be restricted to the areas of disturbance as show in the conceptual mine plan (Plan 3).	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-low	Medium-low	No additional cost	
		1.9	Natural vegetation	Removal of topsoil will lead to the removal of vegetation that is binding the soil and this activity will increase the erosion potential of the area.	• Removal of vegetation during stripping will be minimized to reduce the erosion potential. Topsoil will only be removed off areas proposed for immediate mining as in accordance to the conceptual mine plans (Plan 3).	Environmental co-coordinator	Throughout construction phase	Medium-high	Medium-high	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		1.10	Fauna (mammals, birds, amphibians, reptiles, insects)	Topsoil removal results in the destruction of natural habitats for animals	• Removal of vegetation during stripping will be minimized to reduce the erosion potential. Topsoil will only be removed off areas proposed for immediate mining as in accordance to the conceptual mine plans (Plan 3). All soils should be stored and managed as mentioned in 1.2 -1.3 for rehabilitation to create natural habitats for animals	Environmental co-coordinator	Throughout construction phase	Medium-high	Medium-high	No additional cost	
		1.14	Surface water	Potential localised flooding due to increase in surface run-off quantity and changes to surface	• The period for removing vegetation and topsoil should be targeted for the dry season. Where construction takes place during the wet season, the period should be minimized	Environmental co-coordinator	Throughout the construction phase	Medium-high	Medium-low	R 46 240.00	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				water flow dynamics during the process of vegetation and topsoil removal.	to reduce the effects of increased run-off as a result of exposed soil. Clean and dirty catchment separation canals and berms should be installed prior to the commencement of construction. This will prevent the siltation of runoff and subsequent negative impact on the water resources and catchment as a whole.						
		1.14	Surface water	Siltation as a result of dust created during topsoil removal, transportation and storage. Erosion of the stockpiles and	• Siltation of surface water resources will be minimized by road wetting. The areas excavated should be have berms that are vegetated in order to separate dirty and clean water systems while enhancing the	Environmental co-coordinator	Throughout the construction phase	High	Medium-high	R 46 240.00	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				excavated areas. Contamination of surface water by dirty water from the stockpiles and overburden dug out during the construction phase.	maximization of clean and minimization of dirty areas and water systems respectively, and as an erosion control measure. The stockpiles must be vegetated to prevent erosion and subsequent siltation of clean and dirty water streams as well as surface water resources. Upslope diversion and down slope silt containment structures will be constructed. Monitoring of surface water resource pre-mining and during construction must be implemented in order to be used during operation, decommissioning and						

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					post-closure as per the monitoring programme included in Section 16 of the EIA Report. All applicable DWAF Best Practice Guidelines must be complied with.						
	Storage of topsoil	1.15	Surface water	Storage of topsoil will change the surface water flow dynamics of the area.	• Topsoil and subsoil should be stockpiled within a designated area and not distributed across the site. Such soil can be used for berm construction.	Environmental co-coordinator	Throughout the construction phase	Medium-high	medium - low	R 46 240.00	R 323 680
		1.13	Groundwater	Removal of vegetation and topsoil decreases the recharge of aquifers	• The removal of topsoil and vegetation must be restricted to the areas indicated on the conceptual mine plan (Plan 3).	Environmental co-coordinator	Throughout construction phase	Medium-low	Medium-low	R 48,000.00	R 336 000

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
2	Construction of haul roads			Haul roads to be constructed will be 8m wide with berms constructed on both sides. Berms will be at an angle of 37 degrees with a height of approximately 1.5m. Mitre drains with a width 800mm will be placed at 100m intervals. Silt traps (silt curtains) will be placed within 300m of any rivers or streams. After topsoil is removed, a							

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				600mm think, non-carbaceous clean sandstone base will be layered, followed by a 400mm latent topping. Roads will be treated with a dust suppression chemical (e.g. dust-a-side) and berms vegetated with long grass mix (e.g. tef / eragrostis / smuts vinger).							

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		2.1	Topography	The construction of a haul road results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium - low	Medium - low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				are discussed in their separate sections.							
		2.2	Soils	Compaction of soils due to operation and movement of construction equipment used during haul road construction.	• Construction vehicles will be restricted to areas for topsoil stripping. Topsoil stockpiles must be protected from vehicle movement that may result in compaction and loss of soil structure.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium - low	Medium-low	No additional cost	
		2.3	Land capability	Loss of land capability in haul road areas due to soil compaction.	• Construction equipment must be restricted to areas allocated for haul road construction in order to limit the extent of soil compaction.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium - low	Medium-low	No additional cost	
		2.4	Land use	Change of current land uses to haul road. Very	• All construction activities with regards to the haul road must be limited	Engineer and environmental co-ordinator.	Throughout construction phase	Medium - low	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(Lo M)**
				severe in areas occupied by agriculture.	to the designated haul road route.	Contractor					
		2.5	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas and hard and steep surfaces will increase the velocity of	• All construction activities will be planned and managed to ensure that there will not be a dramatic reduction in catchment size. Efforts will be made to limit the construction of haul roads in wetland areas. Haul roads will be low in gradient to limit reduce runoff velocity limiting erodibility of open surfaces.	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(Lo M)**
				runoff.							
		2.6	Air Quality	The removal of vegetation, movement of machines on haul roads will generate dust, more specifically particulate matter (PM10)	• Road surfaces, for example the access road, will be sprayed and treated with water and a dust binding agent. Haul roads will be treated as required. The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m^3	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium - low	Medium-low	R65 000	R 455 000
		2.7	Noise	Construction activities, including the movement of machines will affect noise levels in the area	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium - low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				negatively	1.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. Switching off equipment when not in use. Construction activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						
		2.8	Natural vegetation	When the haul road is constructed, vegetation	• The clearing of vegetation will be restricted to the area designated for the haul road	environmental co-coordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				will be removed.	construction. One meter area on each side of the haul road can be clear for safety reasons. No vegetation outside of this designated construction area must be removed						
		2.9	Fauna (mammals, birds, amphibians, reptiles, insects)	removal of vegetation will destroy the natural habitats of animals	• The clearing of vegetation will be restricted to the area designated for the haul road construction. One meter area on each side of the haul road can be clear for safety reasons in order to see approaching fauna. No vegetation outside of this designated construction area must be removed. All construction vehicles must adhere	environmental co-coordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					to speed limits.						
		2.10	Surface water	Siltation as a result of dust created during topsoil removal, transportation and storage during the construction of the haul road. Contamination of surface water by dirty water as a result of hydrocarbons and dust.	• A hydrocarbon management system will be implemented. Dust suppression needs to be undertaken. Berms need to be constructed in order to separate clean and dirty water.	environmental co-coordinator	Throughout the construction phase	Medium-high	Medium-low	R 46 240	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		2.11	Surface water	The removal of vegetation increases the erodibility of soils which implies a higher silt loading of water running over exposed soil. If not contained, the water is transported off-site and leads to the siltation of rivers downstream.	• The removal of vegetation will be minimized to reduce the effects of possible silt loading from exposed soil. Erosion control measures such as contour banks will be constructed in areas prone to erosion.	environmental co-coordinator	Throughout the construction phase	Medium-high	Medium-low	R 46 240	R 323 680
		2.12	Surface water	Removal of vegetation and implementation of road erosion	• Removal of vegetation will be minimized during upgrading and widening of haul roads and erosion control measures will	environmental co-coordinator	Throughout the construction phase	High	Medium-high	R 46 240	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				control measures alters surface water flow dynamics	be planned and managed accordingly.						
3	Construction of hydrocarbon storage facility			The hydrocarbon storage facility will consist of a bunded, ventilated portable container with a capacity of approximately $27m^3$. The bunded area shall be fully concreted, 150mm thick with a $1m^3$ sump at the one end.							

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		3.1	Soils	Potential contamination of soil due to hydrocarbon spillage and leaks.	• A hydrocarbon management system will be introduced on site to ensure that potential soil contamination is minimized. Management system will include storage of flammable liquids and chemicals procedure (including MSDS); • Hazardous materials spill procedure; and emergency response procedure.	Environmental co-ordinator	Throughout construction phase	Medium - low	Low	No additional cost	
		3.2	Land capability	Reduction in land capability due to soil contamination by hydrocarbon spillage and leaks.	• In the event of hydrocarbon spillage or leaks, the contaminated soil must be dealt with in accordance to the hydrocarbon management system and the waste management plan.	Specialist contractor	When required	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		3.3	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to hydrocarbon spillage and leaks may impact negatively on wetland functioning	• A hydrocarbon management system will be introduced on site to ensure that potential pollution of the water resource will be minimized	Environmental co-coordinator	Throughout construction phase	Medium - low	Medium - low	No additional cost	
		3.4	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise barriers to be erected near the noise source, between the noise source and receptors; noise barriers will consist of berms. Berms will be at an angle of 37 degrees with a height of approximately 1.5m; • Mining-related machine and vehicles must be serviced on a	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers • Switching off equipment when not in use; • Construction activities will be limited to daytime hours • A Noise Monitoring Programme should be implemented during this phase						
		3.5	Natural vegetation	The construction of the facility will require the removal of vegetation	• The area of vegetation clearing must be restricted to the dimensions of the proposed required clearing as indicated in engineering drawings that are completed prior to	Environmental co-ordinator	Throughout construction phase	Medium - low	Medium - low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					construction.						
		3.6	Fauna (mammals, birds, amphibians, reptiles, insects)	Removal of vegetation will destroy the natural habitats of animals	• The area of vegetation clearing must be restricted to the dimensions of the proposed required clearing as indicated in engineering drawings that are completed prior to construction.	Environmental co-ordinator	Throughout construction phase	Medium - low	Medium - low	No additional cost	
		3.7	Surface water	Hydrocarbon contamination from diesel spillages during the set up of fuel bays and from leaks of trucks filling up.	• A hard park area with bunding must be created for the placement of fuel bay and to contain any diesel spillages from trucks filling up. • An oil trap and separator should be set up at the lowest point of the hard park to separate any oil/diesel from the	Environmental co-ordinator	Throughout the construction phase	High	Medium - low	R 46 240.00	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					runoff emanating from the hard park area.						
		3.8	Surface water	Siltation as a result of dust created during topsoil removal, transportation and storage. Erosion of the stockpiles and excavated areas. Contamination of surface water by dirty water and hydrocarbons from oil and diesel spillages.	• Siltation of surface water resources will be minimized by covering trucks transporting overburden and topsoil to stockpile areas, road wetting must be implemented. • The areas excavated should be have berms that are vegetated in order to separate dirty and clean water systems while enhancing the maximization of clean and minimization of dirty areas and water systems respectively, and as an erosion	Environmental co-ordinator	Throughout the construction phase	Low	Low	R 46 240.00	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					control measure. • The stockpiles must be vegetated to prevent erosion and subsequent siltation of clean and dirty water streams as well as surface water resources. • Upslope diversion and down slope silt containment structures will be constructed. • Monitoring of surface water resource pre-mining and during construction must be implemented in order to be used during operation, decommissioning and post-closure. • The trucks and heavy mining machinery will be fitted with leak trays to capture						

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					any spillages that could result in hydrocarbon contamination.						
4	Construction of offices and change houses			The change house will be a 8m x 25m face brick structure with an IBR roof. Offices will also be face brick with an IBR roof and a size of 12m x 15m.							

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		4.1	Soils	Compaction of soil in areas for office and change house construction.	• Areas used for construction of offices and change houses will be restricted to the areas designated for infrastructure development	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	
		4.2	Land capability	Loss of land capability in areas used for office and change house construction due to soil compaction.	• Areas used for construction of offices and change houses will be restricted to the areas designated for infrastructure development	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	
		4.3	Land use	Change of current land uses to built environment. Very severe in areas occupied by agriculture.	• Areas used for construction of offices and change houses will be restricted to the areas designated for infrastructure development	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	

				Construction Phase								
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**		
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**	
		4.4	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas.	• All construction activities will be planned and managed to ensure that there will not be a dramatic reduction in catchment size and water reporting to the wetland. • Permeable materials to be used i.e. permeable pavements, gardens can be constructed to be below pavement levels and a stormwater runoff programme implemented to minimize loss of water.	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost		
		4.5	Noise	Construction activities, including the movement of machines will	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	No additional cost		

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				affect noise levels in the area negatively	at an angle of 37 degrees with a height of approximately 1.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. S • witching off equipment when not in use. • Construction activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		4.6	Natural vegetation	construction of offices and change house will lead to clearing of vegetation	• Removal of vegetation due to construction of house should only be restricted to the area where the change houses will be built to avoid excess removal of vegetation	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	
		4.7	Fauna (mammals, birds, amphibians, reptiles, insects)	construction of offices and change house will lead to clearing of vegetation and destroying the natural habitats of animals	• All infrastructure must be restricted to areas that have already been disturbed by agriculture	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	
		4.8	Visual	Infrastructure present on site will create a visual disturbance	• All reflective surfaces will be painted with natural tones. Where possible, infrastructure should	Environmental co-ordinator	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				and alter the visual aesthetic of the site.	be placed where it will have a minimal visual disturbance. • Down lighting will be utilized to decrease light pollution in the evenings.						
5	Construction of pollution control dams			Two 8000m^3 will be constructed. Each PCD will be lined with a 2mm HDIE liner. The feed drainage will have a silt trap. Both dams will be 40m x 50m x 4m in size.							
		5.1	Topography	The construction of the	• The mitigation of topography is performed in the post mining topographical	Environmental co-ordinator	Throughout construction phase	Medium - low	Medium - low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				pollution control dams will impact the functioning of topography due to overburden being utilized to alter the site to make it suitable to the establishment of the activity.	plan.						
		5.2	Soils	Compaction of soil in areas for pollution control dam construction.	• Areas used for construction of the pollution control dams will be restricted to the areas designated areas.	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	
		5.3	Land capability	Loss of land capability in area used for pollution control dam	• Areas used for construction of the pollution control dams will be restricted to the areas	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				construction due to soil compaction.	designated areas.						
		5.4	Sensitive landscape (Wetlands)	Reduction in surface and groundwater quality due to dirty water in the pollution control dams as well as potential pollution of surface water resources due the incorrect handling of dirty water may impact negatively on wetland functioning and water quality.	• A waste water management system will be introduced on site to ensure that potential pollution of the water resource will be minimized. • Water will be recycled for use for mining operations and not released back into the system dirty.	Environmental co-ordinator	Throughout the construction phase	Medium - low	Medium - low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		5.5	Air Quality	The excavation of overburden and movement of material will generate dust and will impact on PM10 levels	• Areas to be excavated should be sprayed with water to minimize dust. • Cover hauls trucks hauling excavated material. The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is 40ug/m^3	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	R 65 000	R455 000
		5.6	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 1.5m. • Noise monitoring must be undertaken	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Construction activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						
		5.7	Natural vegetation	construction of pollution control dams could lead to removal of vegetation on site	• Pollution control dams must not be constructed within the wetland areas.	Environmental co-ordinator	Throughout construction phase	Medium - low	Medium-low	No additional cost	

				Construction Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency / Duration	Significance Rating		Financial Plan for Monitoring	
No	Description		Affected environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent (per annum)	Final(LoM)
		5.8	Visual	Infrastructure present on site will create a visual disturbance and alter the visual aesthetic of the site.	• The use of screens and fast growing indigenous vegetation can be utilized to decrease the visual disturbance. • The mitigation of visual impacts will be performed once the site is rehabilitated.	Environmental co-ordinator	Throughout construction phase	Low	Low	No additional cost	
		5.9	Fauna (mammals, birds, amphibians, reptiles, insects)	habitat loss of animals due to vegetation removal	• Pollution control dams must be constructed as close as possible to the proposed mining area as show on the conceptual mine plan (Plan 3). • Pit 2 pollution control dam must be constructed 200m from the edge of the dam. • All pollution control dams must be fenced to prevent animal	Environmental co-ordinator	Throughout construction phase	Medium - low	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(Lo M)**
					access.						
		5.10	Surface water	Decrease of catchment size and surface water volume registering at the nearby streams during the construction of the water pollution control dams.	• Minimum number of dams will be built, and their sizes will be optimised so as to have smaller size dams and catch as much dirty water as possible through utilization of the water continuously for road wetting.	Environmental co-ordinator	Throughout the construction phase	High	Medium-high	R 46 240	R 323 680
		5.11	Surface water	Prevention of surface water resources pollution by dirty water through the construction of water	• The construction of the PCDs on site will be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A4: Pollution Control Dams (August 2007).	Environmental co-ordinator	Throughout the construction phase	High	Medium-low	R 46 240	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				pollution control dams.	• Water pollution control dams needs to be well designed and properly maintained to prevent any leakages or spillages into dirty water into clean water systems						
		5.12	Groundwater	Incorrect construction or poor design will lead to groundwater impacts during the operational phase.	• The construction of the PCDs on site will be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A4: Pollution Control Dams (August 2007). • Ensure design includes lining (HDPE), ensure an approval WULA is in place prior to construction, groundwater monitoring must be implemented before construction is	Engineer and environmental co-ordinator.	Throughout the construction phase	Medium-low	Low	R 46 240	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					initiated in accordance to Section 16 of the EIA Report. Water quality must be in limits of the SANS 241:2005 Drinking water standards.						
6	Construction of storm water diversion berms			Berms will be at an angle of 37 degrees with a height of approximately 0.5m. Berms vegetated with long grass mix (e.g. tef / eragrostis / smuts vinger).							
		6.1	Sensitive landscape (Wetlands)	Loss of water from the natural system due to the	• Berms will be constructed to divert it around the mine workings with the intention of directing	Environmental co-ordinator	Throughout the construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				channeling of water away from seepage areas and water resources as well as pollution of the diverted clean water by mining activities	the water into the natural drainage system downstream of the workings. • Channels will be constructed to limit impacts and loss of quality of water being diverted.						
		6.2	Natural vegetation	Loss of vegetation due to construction of storm water and diversion berms.	• Construction of storm water and diversion berms should be limited to designated areas	Environmental co-ordinator	Throughout construction phase	Medium - low	Medium-low	No additional cost	
		6.3	Fauna (mammals, birds, amphibians, reptiles,	Loss of habitat due to construction of storm water and diversion	• Construction of storm water and diversion berms should be limited to designated areas	Environmental co-ordinator	Throughout construction phase	Medium - low	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
			insects)	berms.							
	Construction of water management facilities (canals etc.)	6.4	Surface water	Alteration of surface water flow dynamics during construction of water management facilities such as dirty water diversion and containment facilities around stockpiles and temporary storage facilities.	• The construction stormwater management measures will be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline G1: Stormwater Management (August 2006). T • he principle of separating clean and dirty water streams while minimizing the dirty area and maximizing the clean areas highly applicable. • Localising the dirty water trenches around the stockpiles and implementing continues pumping	Environmental co-ordinator	Throughout the construction phase	Medium-high	Medium-low	R 46 240	R 323 680

				Construction Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency / Duration	Significance Rating		Financial Plan for Monitoring	
No	Description		Affected environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent (per annum)	Final(LoM)
					mechanisms to remove the dirty water and store it in a PCD which should be lined to prevent further negative environmental impacts.						
		6.5	Surface water	Storm water diversions will alter the flow dynamics of surface water thereby reducing the amount of runoff reporting to the catchment. The dirty area should be maximized where possible.	• The clean catchment should be maximized as much as possible. The natural drainage line should be maintained to reduce the impact on surface water flow dynamics.	Environmental co-ordinator	Throughout the construction phase	High	Medium-low	R 46 240	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
7	Construction of portable crusher plant			The crusher structure will be a galvanized steel structure with open-grid flooring and handrails. It will be 8m high and consist of 2 levels, assessable via a modular staircase. The crusher, of the double roll variety will be mounted within this structure.							
		7.1	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in	• All construction activities will be planned and managed to ensure that there will not be a dramatic	Environmental co-ordinator	Throughout the construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas.	reduction in catchment size. • Permeable materials to be used i.e. permeable pavements and a stormwater runoff programme implemented to minimize loss of water and prevent erodibility of open areas.						
		7.2	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 2.5m. • Noise monitoring must be undertaken in accordance to	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					Section 16 of the EIA Report. • Switching off equipment when not in use. Construction activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						
		7.3	Natural vegetation	loss of vegetation due to construction of portable crasher	• Removal of vegetation due to construction of must be restricted to the area where the crusher will be built to avoid excess removal of vegetation	Environmental co-ordinator	Throughout construction phase	Medium - low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		7.4	Fauna (mammals, birds, amphibians, reptiles, insects)	loss of habitat due to construction of portable crasher	• All infrastructure must be restricted to areas that have already been disturbed by agriculture	Environmental co-ordinator	Throughout construction phase	Medium - low	Low	No additional cost	
		7.5	Visual	Infrastructure present on site will create a visual disturbance and alter the visual aesthetic of the site.	• All reflective surfaces should be painted with natural tones. Where possible, infrastructure should be placed where it will have a minimal visual disturbance. • Down lighting should be utilised to decrease light pollution in the evenings.	Environmental co-ordinator	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		7.6	Surface water	Crusher construction will result in reduction of catchment size and alteration of flow dynamics.	• The crusher area must be isolated by means of bunding, be placed on a hard park area with drains channeling dirty water to the appropriate pollution control facilities. • The drains should be fitted with silt and oil traps and workshop area should be constructed away from the surface water bodies.	Environmental co-ordinator	Throughout construction phase	Low	Low	R 46 240	R 323 680
8	Construction of a workshop			The workshop will be a bolter, galvanized steel structure with a concrete floor of approximately 30m x 12m x							

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				9m in size.							
		8.1	Soils	Compaction of soil in areas for workshop construction.	• Areas used for construction of the workshop will be restricted to the areas designated areas.	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	
		8.2	Land capability	Loss of land capability in areas used for workshop construction due to soil compaction.	• Areas used for construction of the workshop will be restricted to the areas designated areas.	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	
		8.3	Land use	Change of current land uses to built environment. Very severe in areas occupied by agriculture.	• Areas used for construction of the workshop will be restricted to the areas designated areas.	Design and planning engineers	Prior to construction	Medium - low	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		8.4	Sensitive landscape (Wetlands)	Reduction on surface water quantity due to reduction in catchment size reduces the amount of surface water reporting to wetland areas, reducing their size and function. Hardening of surfaces will limit seepage areas.	• All construction activities will be planned and managed to ensure that there will not be a dramatic reduction in catchment size. • Permeable materials to be used i.e. permeable pavements and a stormwater runoff programme implemented to minimize loss of water.	Environmental co-ordinator	Throughout the construction phase	Medium-high	Medium-low	No additional cost	
		8.5	Noise	Construction activities, including the movement of machines will affect noise levels in the area	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				negatively	2.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Construction activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						
		8.6	Natural vegetation	Loss of vegetation due to construction	• Construction will be restricted to areas designated for infrastructure construction	Environmental co-ordinator	Throughout construction phase	Medium - low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				of workshop							
		8.7	Fauna (mammals, birds, amphibians, reptiles, insects)	Loss of habitat due to construction of workshop	• Construction will be restricted to areas designated for infrastructure construction	Environmental co-ordinator	Throughout construction phase	Medium - low	Low	No additional cost	
		8.8	Visual	Infrastructure present on site will create a visual disturbance and alter the visual aesthetic of the site.	• All reflective surfaces should be painted with natural tones. Where possible, infrastructure should be placed where it will have a minimal visual disturbance. • Down lighting should be utilised to decrease light pollution in the evenings.	Environmental co-ordinator	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		8.9	Surface water	Workshop construction will result in reduction of catchment size and alteration of flow dynamics.	• The workshop area must be isolated by means of bunding, be placed on a hard park area with drains channeling dirty water to the appropriate pollution control facilities. • The drains should be fitted with silt and oil traps and workshop area should be constructed away from the surface water bodies.	Environmental co-ordinator	Throughout the construction phase	Medium-high	Medium-low	R 46 240	R 323 680
9	Placement 11KV electrical line	9.1	Natural vegetation	Vegetation will be removed.	• Vegetation clearing must be minimized to the required servitude for such a powerline which between a width of 16m in total to a maximum area of 22m in total	environmental co-coordinator	Throughout construction phase	Medium-high	Medium-low		

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		9.2	Surface water	The placing of pylons will result in the removal of vegetation and soils and thus alteration of the catchment flow dynamics. Natural drainage lines may also be altered	• Pylons should not be placed close to surface water bodies especially where there is a natural drainage line.	Environmental co-ordinator/ Mine engineer	During installation	Medium-low	Low	R 46 240	R 323 680
10	Blasting	10.2	Topography	Blasting of rock results in a disturbance of the natural functioning of the topography, the result of this disturbance	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-high	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				causes impacts on surface and ground water flows as well as visual aesthetics.							
		10.2	Air Quality	Blasting and excavating activities to establish initial cut will generate dust	• Dust fall out during blasting will need to be monitored. • Monitoring weather conditions when blasting especially during the dry season, will minimize the impact of the dust cloud formed from an air blast, by allowing the contractor to know whether the conditions are favorable to perform a blast. • The limit value for the 24 hour average for PM10 is 75 ug/m^3	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium - low	Medium - low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is 40ug/m^3						
		10.3	Noise	Blasting during boxcut establishment will cause noise and vibration	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 5m. Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Construction activities will be limited to daytime hours. Blasting is generally intermittent and should be limited to daylight hours	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-high	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					when ambient noise levels are highest. • The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended; • Reduction of the powder factor, that is, use of less explosive per cubic yard of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed (Sengupta, M.1993). • Workers to be required to be trained in safety and to wear personal protective						

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					equipment e.g. ear plugs.						
		10.4	Visual	Dust as well as the voids caused by blasting has a visual disturbance to surrounding areas.	• The mitigation of visual impacts will be performed once the site is rehabilitated.	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium - low	Medium - low	No additional cost	
		10.5	Surface water	Dust associated with blasting could result in siltation of the surface water bodies	• Dust suppression measure must be put in place.	Environmental co-ordinator/ Mine engineer	During installation	Medium-low	Low	R 46 240	R 323 680
		10.6	Groundwater	Possible nitrate contamination due to miss fires of ammonium	• A blasting programme must be developed prior to the initiation of blasting. All blasting holes must be	Environmental co-ordinator	Throughout construction phase	Medium-low	Low	R 46 240	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				nitrate explosives.	properly lined and charged to ensure detonation.						
		10.7	Air blasting	Blasting activities will result in fly rock which may impact structures close to blasting activities	• A minimum of 30 blast hole diameters in length with a stemming aggregate of 10% blast hole diameter must be implemented to control fly rock. • Blast planning must be undertaken to ensure effective initiation and detonation. • Timing and down hole accessories must be according to accepted standard practice.	Mining engineer	Throughout construction phase	Medium-high	Medium-low		
		10.8	Vibration	Blasting activities will result in ground vibration that	• The use of 280kg from a 165 mm diameter blast hole single charge will be used for blasting to minimize the extent	Mining engineer	Throughout construction phase	Medium-high	Medium-low		

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				may result in structural damage to surrounding infrastructure	of ground vibration experienced. • A structural survey must be conducted of structures that could be impacted on by vibration before blasting is undertaken. • Seismographs must be implemented prior to construction as in terms of section 16 of the EIA.						
11	Development of initial open cast cuts	11.1	Topography	The establishment of initial open cast cut and access ramps results in a disturbance of the natural functioning of the topography, the result of	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-high	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate sections.							
		11.2	Sensitive landscape (Wetlands)	Establishment of opencast areas dewaters surrounding	• All construction activities will be planned and managed to ensure that there will not be a dramatic	Environmental co-ordinator	Throughout construction phase	High	High	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				aquifers	reduction in catchment size and water reporting to the wetland. • Opencast establishment will dewater the surrounding aquifers and the impacts will be unavoidable, because of this mitigation will not be possible.						
		11.3	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 1.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					Report. • Switching off equipment when not in use. Construction activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						
		11.4	Air Quality	The excavation of overburden and movement of material will generate dust and will impact on	• Pre-wet areas to be excavated to minimize dust. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-low	Medium-low	R 65 000	R 455 000

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				PM10 levels	the yearly average for PM10 is 40ug/m^3						
		11.5	Natural vegetation	Vegetation will be cleared and removed during the development of opencast	• The removal of vegetation must be restricted to the area of the initial cuts. • The removal of vegetation must only progress as mining progresses and not be done in advance.	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	
		11.6	Fauna (mammals, birds, amphibians, reptiles, insects)	Habitats will be destroyed during the development of opencast	• The removal of vegetation must be restricted to the area of the initial cuts. • The removal of vegetation must only progress as mining progresses and not be done in advance. • All mining areas must be fenced off to prevent animal access	Environmental co-ordinator	Throughout construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		11.7	Visual	The void created by the initial open cast cut will result in a large visual disturbance.	• The use of screens and fast growing indigenous vegetation can be utilised to decrease the visual disturbance. The mitigation of visual impacts will be performed once the site is rehabilitated.	Environmental co-ordinator	Throughout construction phase	Medium-low	Medium-low	No additional cost	
		11.8	Surface water	Reduction in baseflow and in catchment area size and a change in flow dynamics due to dewatering of surrounding aquifer caused by pumping out of water to ensure dry mine sites.	• Separation of clean and dirty water must be undertaken. Clean water areas must be maximized. • Reuse of inpit/dirty water needs to be maximized.	Engineer and environmental co-ordinator	Throughout entire phase	Medium-high	Medium-low	R 46 240	R 323 680

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
		11.9	Groundwater	Establishment of opencast pit dewaters surrounding aquifers	• During the establishment of the opencast areas the surrounding aquifers will dewater and no mitigation measures are possible. • Where such dewatering causes the drying up of boreholes used for domestic, stock-watering and other uses, alternative supplies of water must be provided on a case-by-case basis.	Environmental co-ordinator/ Mine engineer	Throughout construction phase	Medium-high	Medium-low	R 46 240	R 323 680
12	Stockpiling of soil and overburden from initial cuts	12.1	Soils	Loss of soil fertility and natural soil functioning due to mixing of soil types.	• Different soil types and horizons should be stripped up to the recommended depth and stockpiled separately for use during rehabilitation according to the soil utilisation guide, Plan 20, Section 16.6 of	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					EIA Report. • Topsoil stockpile heights and slopes need to be indicated to prevent erosion. T • opsoil stockpiles must not exceed a height of 3m and a slope of 1:3 (18.5 degrees from the horizontal). I • nitial topsoil stockpiled must be used in rehabilitation as soon as possible. • All topsoil stockpiles must be vegetated as soon as possible to prevent loss of resource. • Topsoil must only be used for rehabilitation purposes.						
		12.2	Soils	Compaction of soil during	• Heights of different stockpiles should be restricted according	Engineer and environment	Throughout constructio	Medium-high	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				stockpiling.	to the heights recommended in the soil utilisation guide.	al co-ordinator. Contractor	n phase				
		12.3	Sensitive landscape (Wetlands)	Sedimentation of the water resources due to erosion of the stockpiles during periods of high rainfall.	• Soil and overburden stockpiles will be vegetated to prevent erosion as well as berms constructed down slope of the piles to trap debris. • The berms will also allow for infiltration of water minimizing loss of water.	Environmental co-ordinator	Throughout construction phase	Medium-low	Medium-low	No additional cost	
		12.4	Air Quality	Windblown soil and coal dust from the stock piles will impact on the dust fallout levels	• Stockpiles to be kept moist when necessary without causing water erosion. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and the limit value may not be exceeded 4 times within a year. • The limit value for the yearly average for	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Low	Low	R 65 000	R455 000

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
					PM10 is 40ug/m^3						
		12.5	Noise	Movement of Haul trucks will generate noise	• Noise barriers to be erected near the noise source, between the noise source and receptors; Berms will be at an angle of 37 degrees with a height of approximately 3.5m.. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers; • Switching off equipment when not in use; • Construction activities will be limited to daytime	Engineer and environmental co-ordinator. Contractor	Throughout construction phase	Medium-low	Low	No additional cost	

				Construction Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency / Duration	Significance Rating		Financial Plan for Monitoring	
No	Description		Affected environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent (per annum)	Final(LoM)
					hours • A Noise Monitoring Programme should be implemented during this phase						
		12.6	Natural vegetation	Movement of trucks will create dust that could lead to the closure of stomata's	• Soil and overburden stockpiles will be vegetated as soon as possible. Dust suppression must be undertaken.	Environmental co-ordinator	Throughout construction phase	Medium-low	Low	No additional cost	
		12.7	Fauna (mammals, birds, amphibians, reptiles, insects)	Compaction of soil during stockpiling could lead due habitat loss.	• Soil and overburden stockpiles must be vegetated as soon as possible.	Environmental co-ordinator	Throughout construction phase	Medium-low	Low	No additional cost	

				Construction Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency / Duration	Significance Rating		Financial Plan for Monitoring	
No	Description		Affected environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent (per annum)	Final(LoM)
		12.8	Topography	Results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Environmental co-ordinator	Throughout construction phase	Medium-low	Medium-low	No additional cost	

				Construction Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency / Duration**	**Significance Rating**		**Financial Plan for Monitoring**	
No	**Description**		**Affected environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent (per annum)**	**Final(LoM)**
				sections.							
		12.9	Visual	Stockpiles have impacts on the surrounds, due to their height and uncharacteristic nature compared to the surrounding area.	• The mitigation of visual impacts will be performed once the site is rehabilitated.	Environmental co-ordinator	Throughout construction phase	Medium-low	Medium-low	No additional cost	

Operational Phase

				Operational Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency/ Duration	Significance Rating		Financial Plan	
No	Description		Affected Environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent	Final
1	Removal of topsoil	1.1	Topography	Removal of topsoil and weathered material from construction areas results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate sections.	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Environmental co-coordinator	Throughout construction phase	Medium-high	Medium-high	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		1.2	Soils	Loss of the original spatial distribution of soil types and natural soil horizon sequences.	• The areas to be stripped will be restricted to the areas of disturbance as show in the conceptual mine plan (Plan 3). • As mining progresses soil must be used as soon as possible for rehabilitation	Mine manager and environmental manager	Throughout operational phase	Medium-high	Medium-high	No additional cost	
		1.3	Soils	Loss of soil fertility, original soil depth and volume, as well as natural soil functioning.	• Different soil types and horizons should be stripped up to the recommended depth and stockpiled separately for use during rehabilitation according to the soil utilisation guide, Plan 20, Section 16.6 of EIA Report. • Topsoil stockpile heights and slopes need to be indicated to prevent erosion. • Topsoil stockpiles must not exceed a height of 3m and a slope of 1:3 (18.5 degrees from the horizontal). Initial	Mine manager and environmental manager	Throughout operational phase	Medium-high	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					topsoil stockpiled must be used in rehabilitation as soon as possible. • All topsoil stockpiles must be vegetated as soon as possible to prevent loss of resource. Topsoil must only be used for rehabilitation purposes.						
		1.4	Soils	Compaction of soil due to movement of heavy mining vehicles.	• Mining vehicles will be restricted to areas for topsoil stripping. • Topsoil stockpiles must be protected from vehicle movement that may result in compaction and loss of soil structure.	Mine manager and transport contractor	Throughout operational phase	Medium-high	Medium-low	No additional cost	

				Operational Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency/ Duration	Significance Rating		Financial Plan	
No	Description		Affected Environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent	Final
		1.5	Land capability	Land capability will be reduced in areas stripped of topsoil, due to loss of soil fertility, original soil depth and volume, as well as natural soil functioning and soil compaction.	• As mining progresses soils that are stripped must be stockpile according to horizon. • Topsoil must be stockpile separately for final rehabilitation purposes. Stockpiles should be vegetated to minimize soil loss. • Topsoil stockpile heights and slopes need to be indicated to prevent erosion. • Topsoil stockpiles must not exceed a height of 3m and a slope of 1:3. Initial topsoil stockpiled must be used in rehabilitation as soon as possible. A • ll topsoil stockpiles must be vegetated • as soon as possible to prevent loss of resource. Topsoil must only be used	Mine manager and environmental manager	During rehabilitation	Medium-high	Medium-low	Dependent on number and size of topsoil stockpiles, however, a cost of R 15.25/m3 has been estimated for vegetation	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					for rehabilitation purposes.						
		1.6	Land use	Change of current land uses to mining. Very severe in areas occupied by agriculture.	• The areas of disturbance will be restricted in accordance with the conceptual mine plan, Plan 3.	Mine manager and environmental manager	Throughout operational phase	Medium-high	Medium-low	No additional cost	
		1.7	Sensitive landscape (Wetlands)	Sedimentation of the water resources due to erosion of the overburden during periods of high rainfall. Topsoil and overburden stripping and vegetation removal reduces recharge of shallow aquifers that	• Removal of vegetation during stripping and construction activities will be minimized to reduce the erosion potential. • Topsoil will only be removed off areas proposed for immediate mining. • Wetland soils of soil types Ka and Lo1 in certain areas should be avoid where	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				feed hillslope wetlands, reducing flow in water resources. This activity will increase the erosion potential of the area.	possible and where mined piled and stored correctly for rehab purposes. • Disturbance to vegetation and sensitive landscapes will be restricted to the conceptual mine plan, Plan 3.						
		1.8	Air Quality	The stripping of topsoil, exposing subsoil will impact on the dust fallout levels as well as the PM10 levels	• The removal of vegetation will be minimized during stripping to reduce the effects of dust pollution as a result of exposed soil. • Cover haul trucks hauling soils	Environmental manager / contractor	Throughout operational phase	Medium-high	Medium-low		
		1.9	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • If monitoring suggests noise barriers to be constructed, berms will be at an angle of 37 degrees with a height of approximately 2.5m.	Environmental manager / contractor	Throughout operational phase	Medium-low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					• Switching off equipment when not in use. Operational activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						
		1.10	Natural environment	Removal of topsoil will lead to vegetation loss	• Removal of vegetation during stripping will be minimized to reduce the erosion potential. • Topsoil will only be removed off areas proposed for immediate mining as in accordance to the conceptual mine plans (Plan 3).	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		1.11	Fauna (mammals, birds, reptiles, insects)	Habitat will be destructed by the removal of topsoil	• Removal of vegetation during stripping will be minimized to reduce the erosion potential. • Topsoil will only be removed off areas proposed for immediate mining as in accordance to the conceptual mine plans (Plan 3). • All soils should be stored and managed as mentioned in 1.2 -1.3 for rehabilitation to create natural habitats for animals	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		1.12	Surface water	Siltation as a result of dust created during topsoil removal, transportation and storage. Erosion of the stockpiles and excavated areas. Contamination of surface water by dirty water from the stockpiles and overburden dug out during the construction phase.	• Siltation of surface water resources will be minimized by road wetting. T • he areas excavated should be have berms that are vegetated in order to separate dirty and clean water systems while enhancing the maximization of clean and minimization of dirty areas and water systems respectively, and as an erosion control measure. • The stockpiles must be vegetated to prevent erosion and subsequent siltation of clean and dirty water streams as well as surface water resources. • Upslope diversion and down slope silt containment structures will be constructed. • Monitoring of surface water	Environmental co-coordinator	Throughout operational phase	High	Medium-high	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					resource pre-mining and during construction must be implemented in order to be used during operation, decommissioning and post-closure as per the monitoring programme included in Section 16 of the EIA Report. • All applicable DWAF Best Practice Guidelines must be complied with.						
2	Blasting	2.1	Air Quality	Blasting and excavating activities to establish box cut will generate dust	• Dust fall out during blasting will need to be monitored. Monitoring weather conditions when blasting especially during the dry season will minimize the impact of the dust cloud formed from an air blast, by allowing the contractor to know whether the conditions	Environmental manager / contractor	Through out operational phase	Medium-low	Medium-low		

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					are favorable to perform a blast. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is 40ug/m^3						
		2.2	Noise	Blasting during boxcut establishment will cause noise and vibration	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 1.5m. Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Construction activities will be limited to daytime hours. • Blasting is generally	Environmental manager / contractor	Throughout operational phase	Medium-high	Medium-high	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					intermittent and should be limited to daylight hours when ambient noise levels are highest. • The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended; • Reduction of the powder factor, that is, use of less explosive per cubic yard of overburden; • Restriction of blasting to daylight hours are mitigation measures that should be followed (Sengupta, M.1993). • Workers to be required to be trained in safety and to wear personal protective equipment e.g. ear plugs.						

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		2.3	Topography	Blasting of rock results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics.	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Environmental manager / contractor	Throughout construction phase	Medium-high	Medium-high	No additional cost	
		2.4	Visual	Dust as well as the voids caused by blasting has a visual disturbance to surrounding areas.	• The mitigation of visual impacts will be performed once the site is rehabilitated.	Environmental manager / contractor	Throughout construction phase	Medium - low	Medium - low	No additional cost	
		2.5	Surface water	Dust associated with blasting could result in siltation of water resources.	• Dust suppression must be implemented during blasting and the chemicals used must be biodegradable	Environmental manager / contractor	Throughout operational phase	High	Medium-high	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
			Surface water	Reduction of the catchment size due to increased surface water ponding in the opencast created by blasting of rocks	• Refilling of previously blasted areas will be implemented.	Environmental manager / contractor	Throughout operational phase	High	Medium-high	R 46 240	R 323 680
			Surface water	Increased nitrate levels due to blasting.	• Spillages of ammonium nitrate-based explosives will be monitored and managed to minimize the potential of surface water pollution.	Environmental manager / contractor	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680
		2.6	Ground water	Possible nitrate contamination due to miss fires of ammonium nitrate explosives.	• A blasting programme must be developed prior to the initiation of blasting. • All blasting holes must be properly lined and charged to ensure detonation.	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680
		2.7	Air blasting	Blasting activities will result in fly rock which may impact structures close to blasting activities	• A minimum of 30 blast hole diameters in length with a stemming aggregate of 10% blast hole diameter must be implemented to control fly rock.	Mining engineer	Throughout operational phase	Medium-high	Medium-low		

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					• Blast planning must be undertaken to ensure effective initiation and detonation. • Timing and down hole accessories must be according to accepted standard practice.						
		2.8	Vibration	Blasting activities will result in ground vibration that may result in structural damage to surrounding infrastructure	• The use of 280kg from a 165 mm diameter blast hole single charge will be used for blasting to minimize the extent of ground vibration experienced. A structural survey must be conducted of structures that could be impacted on by vibration before blasting is undertaken. Seismographs must be implemented prior to construction as in terms of section 16 of the EIA.	Mining engineer	Throughout operational phase	Medium-high	Medium-low		

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		2.9	I&APs	Blasting will impact on surrounding structures and may be nuisance to people living in close proximity to the site	• The mitigation measures in 10.7 and 10.8 must be implemented. • A complaints register must be kept. All adjacent landowners must be informed of the blasting schedule. • Any damage cause must be dealt with on a case by case situation.	Mining engineer and Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-high		
3	Transportation of coal	3.1	Soils	Potential contamination of soil due to spillage of coal during transport.	• All coal haulage trucks must be covered.	Environmental co-coordinator	Throughout operational phase	Low	Low	No additional cost	
		3.2	Air Quality	Potential windblown coal dust during transport	• Trucks transporting coal will be covered with a tarpaulin to prevent coal spillage. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year.	Environmental co-coordinator/contractor	Throughout operational phase	Low	Low	R65 000	R455 000

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					• The limit value for the yearly average for PM10 is 40ug/m^3						
		3.3	Noise	Movement of Haul trucks will generate noise	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 1.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Operational activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression	Environmental co-coordinator/contractor	Throughout operational phase	Low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					mechanisms are effective e.g. installing exhaust mufflers.						
		3.4	Natural environment	Coal dust could cause detrimental effects on the growth of plants	• All coal haulage trucks must be covered.	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	
		3.5	Surface water	Dust created during the conveyance of coal will lead to siltation of the water resources.	• Cover of trucks transporting the coal.	Contractor and environmental coordinator.	Throughout the operation phase.	Medium-low	Low	R 46 240	R 323 680
		3.6	Traffic and safety	The transportation of coal will result in increased traffic on local and regional	• Speed limits must be implemented on site. Safe access to the site must be established. All traffic incidents all roads must be	Contractor and mining engineer.	throughout the life of mine	Medium-high	Medium-high		

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				roads. This will also increase the safety risk of road users.	reported to management.						
4	Use and maintenance of haul roads	4.1	Soils	Compaction of soils due to movement of mining vehicles and equipment on haul roads.	• Mining vehicles and equipment must be restricted to haul roads and areas in which mining activities are been undertaken.	Mine manager and transport contractor. Environmental manager.	Throughout operational phase and during rehabilitation.	Medium-low	Medium-low	No additional cost	
		4.2	Land capability	Loss of land capability in haul road areas due to soil compaction.	• Mining vehicles and equipment must be restricted to haul roads and areas in which mining activities are been undertaken.	Mine manager and transport contractor. Environmental manager.	Throughout operational phase and during rehabilitation.	Medium-low	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		4.3	Noise	Noise generated by the Haul trucks using the haul roads, the water browser applying dust suppression to the haul road as well as the machinery responsible for maintaining the haul roads	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 2.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Construction activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.	Environmental manager / contractor	Throughout operational phase	Medium-low	Low	No additional cost	

				Operational Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		4.4	Air Quality	Machinery and Haul trucks moving on Haul roads will impact on the dust fallout levels as well as the level of particulate matter	• Road surfaces, for example the access road, will be sprayed and treated with water and a dust binding agent. • Water will be applied to haul roads three times daily, except during periods of rainfall. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is 40ug/m^3	Environmental manager / contractor	Throughout operational phase	Medium-low	Low	R65 000	R455 000
		4.5	Natural environment	dust emitted from the haul roads could cause blockage to stomata's	• Coal haulage trucks must be covered. Dust suppression must be undertaken.	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	
		4.6	Fauna	accidental death of	• Speed limit must be implemented and must be	Environment	Through	Medium-	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
			(mammals, birds, reptiles, insects)	animals caused by trucks	adhered to.	al co-coordinator	out operational phase	low			
5	Upgrade & widening of haul road	5.1	Surface water	The removal of vegetation increases the erodibility of soils which implies a higher silt loading of water running over exposed soil. If not contained, the water is transported off-site and leads to the siltation of rivers downstream.	• The removal of vegetation will be minimized to reduce the effects of possible silt loading from exposed soil. • Erosion control measures such as contour banks will be constructed in areas prone to erosion.	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680
6	Upgrade & widening of haul road	6.1	Surface water	Removal of vegetation and implementation of road erosion control measures alters surface water flow dynamics	• Removal of vegetation will be minimized during upgrading and widening of haul roads and erosion control measures will be planned and managed	Environmental co-coordinator	Throughout operational phase	High	Medium-high	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					accordingly.						
7	Vehicular movement along the haul road	7.1	Surface water	There is a risk of surface water through the washing away by rain of spills of hydrocarbons, chemicals and coal being spilled by trucks and mining equipment	• A hydrocarbon management system will be implemented. • Hydrocarbons and chemicals will be transported, loaded, and stored in accordance with legislation and SANS codes.	Environmental co-coordinator	Throughout operational phase	High	Medium-high	R 46 240	R 323 680
8	Domestic and industrial waste storage and removal	8.1	Soils	Potential contamination of soil due to incorrect handling of industrial wastes.	• Appropriate waste management plan must be implemented. In the event of soil contamination must be dealt with in accordance to the waste management plan.	Environmental manager and specialist contractor.	Through out life of mine and in the event of spillage.	Low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		8.2	Land capability	Reduction in land capability due to soil contamination due to incorrect handling of industrial wastes.	• Appropriate waste management system must be implemented. In the event of soil contamination must be dealt with in accordance to the waste management system.	Environmental manager and specialist contractor.	Throughout life of mine and in the event of spillage.	Low	Low	No additional cost	
		8.3	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to pollutant and toxicant spillage and leaks may impact negatively the water resources.	• Waste management will be ongoing throughout the life of the mine. • This will ensure that the potential pollution of the water resources due to the incorrect handling of industrial and domestic wastes and sewerage will be minimized avoiding impacts to the water resource.	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	
		8.4	Natural environment	Potential contamination of soil due to incorrect handling of industrial wastes could have	• Appropriate waste management system must be implemented and adhered to. • In the event of soil contamination, the	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				negative impacts on the growth of the plants.	contaminated soil must be handled as waste and must remove off-site.						
		8.5	Fauna (mammals, birds, reptiles, insects)	Incorrect handling of chemicals could cause death to animals	• Appropriate waste management system must be implemented and adhered to. In the event of soil contamination, the contaminated soil must be handled as waste and must remove off-site.	Environmental co-coordinator	Through out operational phase	Medium-low	Low	No additional cost	
		8.6	Ground water	If domestic and industrial waste is not properly stored or removed, there is a risk of leaching of contaminated water into the groundwater	• Waste management plan will be prepared in accordance with best practice and applicable guidelines which must be implemented and adhered to.	Environmental co-coordinator	Through out operational phase	Medium-low	Low	R 46 240	R 323 680
		8.7	Surface water	Incorrect storage and handling of chemicals could cause the	• Storage facilities with bunding must be constructed on a hard park area. An emergency spillage protocol	Environmental co-coordinator	Through out operation	Medium-high	Medium-low	R 46 240	R 323 680

				Operational Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency/ Duration	Significance Rating		Financial Plan	
No	Description		Affected Environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent	Final
				deterioration of water quality	must be developed and accessible.		al phase				
9	Hazardous waste storage and removal	9.1	Soils	Potential contamination of soil due to incorrect handling of hazardous wastes.	• Appropriate waste management plan must be implemented. In the event of soil contamination must be dealt with in accordance to the waste management plan.	Environmental manager and specialist contractor.	Through out life of mine and in the event of spillage.	Low	Low	No additional cost	
		9.2	Land capability	Reduction in land capability due to soil contamination due to incorrect handling of hazardous wastes.	• Appropriate waste management plan must be implemented. In the event of soil contamination must be dealt with in accordance to the waste management plan.	Environmental manager and specialist contractor.	Through out life of mine and in the event of spillage.	Low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		9.3	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to the incorrect handling of hazardous, industrial and domestic wastes and sewerage may impact negatively the water resources.	• Waste management will be ongoing throughout the life of the mine. • This will ensure that the potential pollution of the water resources due to the incorrect handling of hazardous wastes will be minimized in an attempt to prevent impact to water quality.	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	
		9.4	Natural environment	Potential wilting and eventual death of vegetation due to leakage of fuels and lubricants	• A hydrocarbon management system and waste management system must be implemented and adhered to throughout the life of the mine. • This will ensure that the potential pollution of the water to natural vegetation due to the incorrect handling of hazardous wastes will be minimized	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		9.5	Fauna (mammals, birds, reptiles, insects)	Incorrect handling of hazardous, industrial and domestic wastes and sewerage may impact negatively on the animal's diet	• A hydrocarbon management system and waste management system must be implemented and adhered to throughout the life of the mine. • This will ensure that the potential pollution of the water to natural vegetation due to the incorrect handling of hazardous wastes will be minimized • An alien invasive species management programme must be implemented. In the event of signs initial erosion, erosion prevention methods must be implemented.	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	
		9.6	Ground water	Potential for groundwater contamination due to the incorrect handling and disposal of	• Waste management plan should be prepared in accordance with best practice and applicable guidelines and must be implemented and adhered to.	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				hazardous waste							
		9.7	Surface water	Risk of contamination of the surrounding surface water resources from improper storage, and removal of domestic, industrial and hazardous waste.	• Waste management plan will be prepared and implemented in accordance with national guidelines.	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680
10	Operation of portable ablutions/change house	10.1	Soils	Potential contamination of soil due to incorrect handling of sewage.	• Appropriate waste management plan must be implemented. In the event of soil contamination must be dealt with in accordance to the waste management plan.	Environmental manager and specialist contractor.	Throughout life of mine and in the event of spillage.	Low	Low	No additional cost	
		10.2	Land capability	Reduction in land capability due to soil contamination due to	• Appropriate waste management plan must be implemented. • In the event of soil	Environmental manager and specialist	Throughout life of mine	Low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				incorrect handling of sewage.	contamination must be dealt with in accordance to the waste management plan.	contractor.	and in the event of spillage.				
		10.3	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to the incorrect handling of domestic wastes and sewerage may impact negatively the water resources.	• Waste management will be ongoing throughout the life of the mine. • This will ensure that the potential pollution of the water resources due to the incorrect handling of sewerage will be minimized to prevent impacts to water quality.	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	
		10.4	Ground water	Potential for the contamination of ground water due to incorrect sewerage handling.	• Plans will be put in place to ensure proper servicing and maintenance of the potable ablution facilities. • Documentation must be made available from the contractor on the location for the disposing of the sewage as well as certificates for the	Environmental manager and specialist contractor.	Throughout life of mine and in the event of spillage.	Low	Low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					collecting, handling, transportation and disposing of sewage.						
	Service and maintenance of portable ablution facilities	10.5	Surface water	Potential for the contamination of surface water due to incorrect sewerage handling.	• It will be ensure proper servicing and maintenance of the potable ablution facilities is undertaken.	Environmental manager and specialist contractor.	Through out life of mine and in the event of spillage.	Medium-high	Medium-low	R 46 240	R 323 680
	Water use	10.6	Surface water	Decrease in imported (potable) water demand through re-cycling and re-use of in-pit water for the mine operations.	• Water recycling will be undertaken in accordance with the DWAF Best Practice Guidelines H3 Water Re-use and Reclamation to maximize the reuse of dirty water.	Environmental manager and specialist contractor.	Through out life of mine and in the event of spillage.	Medium-low	Low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
11	Operation of fuel depot	11.1	Soils	Potential contamination of soil due to hydrocarbon spillage and leaks.	• A hydrocarbon management system will be introduced on site to ensure that potential contamination of soils will be minimized. In the event of spillage, the contaminated soil must be removed off-site or rehabilitated where possible. • The management system will include storage of flammable liquids and chemicals procedure (including MSDS); • Hazardous materials spill procedure; and emergency response procedure.	Environmental manager and specialist contractor.	Through out life of mine and in the event of spillage.	Low	Low	No additional cost	
		11.2	Land capability	Reduction in land capability due to soil contamination due to hydrocarbon spillage and leaks.	• A hydrocarbon management system will be introduced on site to ensure that potential contamination of soils will be minimized	Environmental manager and specialist contractor.	Through out life of mine and in the event of	Low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
							spillage.				
		11.3	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to hydrocarbon spillage and leaks may impact negatively the water resources.	• A hydrocarbon management system will be introduced on site to ensure that potential pollution of the water resource will be minimized to prevent impacts to water quality.	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	
		11.4	Air Quality	Potential impact on the ambient air quality due to leaks that may cause the Volatile organic compounds (VOC's) to escape into the atmosphere	• A hydrocarbon management system will be introduced on site to ensure that potential pollution of the atmosphere will be minimized • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is $40ug/m^3$	Environmental manager and specialist contractor.	Throughout operational phase	Low	Low	R65 000	R455 000

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		11.5	Natural environment	Potential wilting and eventual death of vegetation due to leakage of fuels and lubricants	• Hydrocarbon management system must be implemented and adhered to throughout the life of the mine. • This will ensure that the potential pollution of the water to natural vegetation due to the incorrect handling of hazardous wastes will be minimized.	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	
		11.6	Fauna (mammals, birds, reptiles, insects)	Incorrect handling of hazardous, industrial and domestic wastes and sewerage may impact negatively on the animal's diet	• Hydrocarbon management system must be implemented and adhered to throughout the life of the mine. • This will ensure that the potential pollution of the water to natural vegetation due to the incorrect handling of hazardous wastes will be minimized.	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		11.7	Ground water	Potential for the contamination of ground water due to possible leaks and spills resulting from poor servicing and maintenance of the hydrocarbon storage facilities.	• The hydrocarbon storage facility must be bunded to with hold a capacity of a 110 % of the total volume stored within. • Dispensing of fuels must occur on a hard park area. • The refueling nozzle must either be place within the bunded area or a drip tray must be provided. Soil contamination must be dealt with in accordance to the hydrocarbon management system. • Groundwater monitoring must be undertaken in accordance to Section 16 of the EIA Report. Borehole must be drilled downstream of the hydrocarbon facility and needs to be monitored for hydrocarbon contamination.	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		11.8	Surface water	Hydrocarbon contamination from diesel spillages during the set up of fuel bays and from leaks of trucks filling up.	• A hard park area with bunding must be created for the placement of a fuel bay and to contain any diesel spillages from trucks filling up. • An oil trap should be set up at the lowest point of the hard park to separate any oil/diesel from the runoff emanating from the hard park area.	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680
20	Operation of pollution control dam and storm water management systems	20.1	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to dirty water spillage and leaks may impact negatively the water resources, impacting on ecological functioning and water quality.	• Water management will be ongoing throughout the life of the mine. T • his will ensure that the potential pollution of the water resources due to the incorrect handling of dirty water and wastes will be minimized. • All applicable DWAF Best Practice Guidelines must be complied with and in	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					particular, the operation of the PCDs on site will be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A4: Pollution Control Dams (August 2007).						
		20.2	Surface water	Prevention of surface water resources pollution by dirty water during maintenance and cleaning of water pollution control dams.	• Water pollution control dams needs to be well designed and properly maintained to prevent any leakages or spillages into dirty water into clean water systems. • The operation of the PCDs on site will be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A4: Pollution Control Dams (August 2007).	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-high	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
			Surface water	The excessive re-cycling of water for use in the mining processes further deteriorates the quality of water	• Recycled water will be diluted to meet the quality and quantity demands. • All applicable DWAF Best Practice Guidelines for water management must be complied with and in particular, the DWAF: Best Practice Guideline H3: Water Reuse and Reclamation (June 2006).	Environmental manager and specialist contractor.	Throughout life of mine and in the event of spillage.	Medium-high	Medium-low	R 46 240	R 323 680
		20.3	Ground water	Potential of contamination of groundwater due to leakages or spillages of polluted water from the pollution control dam	• The pollution control dam will be adequately designed and built to specification. • It will also be monitored to ensure quick leak detection. Water will be reused and operational level kept within 0.8m freeboard. • All applicable DWAF Best Practice Guidelines must be complied with and in particular, the operation of the PCDs on site will be	Engineer and environmental coordinator		Medium-high	Low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A4: Pollution Control Dams (August 2007).						
21	Removal of overburden and backfilling	21.1	Sensitive landscape (Wetlands)	Sedimentation of the water resources due to erosion of the overburden during periods of high rainfall. Topsoil and overburden stripping and vegetation removal reduces recharge of shallow aquifers that feed hillslope wetlands, reducing flow in water resources.	• Removal of vegetation during stripping will be minimized to reduce the footprint area and ultimately the erosion potential. • Topsoil will only be removed off areas proposed for immediate mining.	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	No additional cost	

				Operational Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency/ Duration	Significance Rating		Financial Plan	
No	Description		Affected Environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent	Final
		21.2	Air Quality	The activities regarding the removal of overburden and backfilling will generate dust and impact on the dust fallout levels, as well as the levels of particulate matter (PM10)	• When backfilling during earthmoving operations, dedicate a water truck or large hose to backfilling equipment and operations and apply water as needed; or, cover or enclose stationary backfill material; if needed, mix backfill soil with water prior to moving. • Empty loaders buckets slowly and minimize their drop heights. • Immediately after backfilling, apply soil stabilization compounds to form a crust. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m^3	Environmental manager and specialist contractor.	Throughout operational phase	Medium-low	Low	R65 000	R455 000

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		21.3	Noise	Mining machinery responsible for the removal of overburden and backfilling will generate noise	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 2.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Operational activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.	Environmental manager and specialist contractor.	Throughout operational phase	Low	Low	No additional cost	

				Operational Phase						
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency/ Duration	Significance Rating		Financial Plan	
No	Description		Affected Environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent	Final
		21.4	Natural environment	Dust generated during mining activities could suppress the growth of the plants by closing stomata's	• Dust suppression must be undertaken	Environmental co-coordinator	Throughout operational phase	Medium-low	Low	No additional cost	
		21.5	Topography	Results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate sections.	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
22	Stockpiling of overburden	22.1	Surface water	Acid mine drainage formation from prolonged exposure of the overburden excavated from the initial boxcut to rain and air. AMD impacts surface water quality on a national/international scale since the stream passing through the proposed mining area is international.	• Where there is water accumulation in trenches and other areas, a continuous pumping system must be implemented to avoid prolonged exposure of the water to air and in contact with the pyretic material. • Various methods will be implemented which will be utilised to minimize the severity of AMD including the lining of the in-pit sump to which the water will be pumped.	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680
		22.2	Ground water	Dewatering- During the excavation of overburden from the opencast areas, aquifers could be intercepted. This could lead to the dewatering of surrounding aquifers	• The dewatering of aquifers during the operational phase is implicit in the types of mining involved and cannot be prevented. • Alternative supplies of water will be provided on a case-by-case basis.	Engineer and environmental coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680

				Operational Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				and impact on groundwater users.							
23	Mining process removal of coal	23.1	Sensitive landscape (Wetlands)	Recharge of shallow aquifers that feed hillslope wetlands, reducing flow in water resources. Establishment of opencast areas dewaters surrounding aquifers	• All operation activities will be planned and managed to ensure that there will not be a dramatic reduction in catchment size and water reporting to the wetland. • Opencast establishment will dewater the surrounding aquifers and the impacts will be unavoidable, because of this mitigation will not be possible. • Offset mitigation may be suggested for the cumulative loss of wetland areas. • Mining activities should not take place within the wetland areas and allocated buffer zones demarcated on	Environmental coordinator	Throughout operational phase	High	High	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					Plan 20 of the EIA.						
		23.2	Air Quality	The removal of coal will generate coal dust	• Apply dust suppression techniques e.g. wetting during the removal of coal. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is $40ug/m^3$	Environmental manager and specialist contractor.	Throughout operational phase	Medium-low	Medium-low	R130 000	R910 000

				Operational Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		23.3	Noise	The plant used during the removal of coal will generate noise	• Noise barriers must be constructed to attenuate noise levels in the form of berms around the point of source. Berms will be at an angle of 37 degrees with a height of approximately 2.5m. • Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Operational activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.	Environmental manager and specialist contractor.	Throughout operational phase	Medium-low	Low	No additional cost	

				Operational Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		23.4	Topography	The removal of coal will result in a decrease in the elevation of topography, thus causing impacts to surface water runoff.	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	
		23.5	Surface water	Acid mine drainage formation from prolonged exposure of the overburden excavated from the initial boxcut to rain and air. AMD impacts surface water quality on a national/international scale since the stream passing through the proposed mining area is international.	• where there is water accumulation in trenches and other areas, a continuous pumping system must be implemented to avoid prolonged exposure of the water to air and in contact with the pyretic material. Various methods will be implemented which will be utilised to minimize the severity of AMD including the lining of the in-pit sump to which the water will be pumped. (need to provide more details on these methods to be used?)	Environmental co-coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		23.6	Surface water	As more areas are excavated for the removal of coal catchment will be further decreased. The conveyance of coal could result in siltation and deterioration of water quality from chemicals used during blasting. Diesel spillages from the transportation of coal can negatively impact on water quality.	• On-going rehabilitation must be implemented in order to restore the lost catchments. • Coal conveyance must be with covered trucks or conveyor belt. Truck must be fitted with diesel leak collection trays.	Environmental co-coordinator	Throughout operational phase	High	Medium-high	R 46 240	R 323 680
			Surface water	Altered surface water flow dynamics - The removal of overburden and mining of coal will reduce the catchment size, thereby decreasing the amount of water	• Opencast mining will not be done beyond the 1:100 year floodline. Mining activities will comply with the mining plan.	Environmental co-coordinator	Throughout operational phase	High	Medium-high	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				reporting to surface streams on and off site.							
		23.7	Ground water	Acid mine drainage - There is a risk of the formation of AMD when stockpiling and exposing the overburden and coal excavated from the opencast areas to rain. Exposed coal can also form AMD. AMD impacts groundwater quality on a regional scale.	• All mine water generated will be kept within a dirty water system. • Material with a higher likelihood of acidification must be placed in parts of the pit where flooding is possible.	Environmental coordinator	Throughout operational phase	Medium-high	Medium-low	R 46 240	R 323 680
24	Crushing of coal	24.1	Air Quality	The crushing activities will generate dust which impacts on the dust fallout levels and	• The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year.	Environmental manager and specialist contractor.	Throughout operational phase	Low	Low		

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				particulate matter levels (PM10)	• The limit value for the yearly average for PM10 is 40ug/m[3]						
		24.2	Surface water	Dust resulting from the coal crushing could result in siltation of the water resources. Dirty water associated with the coal beneficiation could negatively impact on the water quality.	• The coal crushing plant should be covered and dust suppression measures must be installed. • The water associated with the coal crushing plant must be directed to a pollution control facility which is in line with GN R704 requirements of capacity.	Environmental manager and specialist contractor.	Throughout operational phase	High	Medium-high	R 46 240	R 323 680
25	ROM coal Stockpile	25.1	Soils	Potential contamination of soil by AMD from ROM coal stockpiles.	• Berms must be created below the piles to trap coal particles and runoff from the coal stockpile	Environmental manager	Prior to operational phase	Low	Low	No additional cost	
		25.2	Land capability	Reduction in land capability due to soil contamination by AMD from ROM coal stockpiles.	• Berms must be created below the piles to trap coal particles and runoff from the coal stockpile	Environmental manager	Prior to operational phase	Low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		25.3	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to the runoff from the stockpiles may impact negatively on the water resources.	• Berms created below the piles to trap coal particles and runoff from the coal stockpile minimising impacts to water quality as well as minimising loss of water.	Environmental co-coordinator	Through out operational phase	Medium-low	Medium-low	No additional cost	
		25.4	Air Quality	Potential impact on ambient air quality due to windblown dust particles from stock piles	• Spray stockpiles with water. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is $40ug/m^3$	Environmental manager and specialist contractor.	Prior to operational phase	Low	Low		
		25.5	Topography	Results in a disturbance of the natural functioning of the topography, the result of this disturbance causes impacts on surface and ground	• The mitigation of topography will be undertaken during decommissioning and will be incorporated in the closure plan.	Environmental manager	Through out operational phase	Medium-low	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				water flows as well as visual aesthetics. Where slope percentages are altered there is the potential to increase soil erode ability. These impacts are discussed in their separate sections.							
		25.6	Surface water	water around the coal stockpile is deemed contaminated and if not contained could result in water quality deterioration. The dirty water contained should be re-used/recycled to prevent overflow and spillage. Prolonged exposure of the dirty water to air could spark AMD generation.	• Water from the ROM coal stockpile should be channelled to pollution control facilities designed and constructed according to GN 704 requirements of capacity during operation. • Re-use of the water must be implemented for dust suppression and as coal washing water. All applicable DWAF Best Practice Guidelines for surface water management	Environmental manager and specialist contractor.	Throughout the operational phase and beyond.	High	Medium-high	R 46 240	R 323 680

				Operational Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					must be complied with and in particular • Water management measures should be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A5: Water Management for Surface Mines (July 2008).						
		25.7	Ground water	There is a risk of the formation of AMD when stockpiling and exposing the overburden and coal excavated from the opencast areas to rain. Exposed coal can also form AMD. AMD impacts groundwater quality on a regional scale.	• Intercept all seepage from stockpiles. Monitor downstream groundwater quality to ensure no contamination is taking place in accordance to Section 16 of the EIA Report. Water quality must be with in the limits of SANS 241:2005 • Drink water standards. All applicable DWAF Best Practice Guidelines for groundwater management	Environmental coordinator	Throughout the operational phase and beyond.	Medium-high	Medium-low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					must be complied with and in particular Water management measures should be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A5: Water Management for Surface Mines (July 2008).						
36	Maintenance of equipment	26.1	Soils	Potential contamination of soil due to hydrocarbon spillage and leaks.	• A hydrocarbon management system will be introduced on site to ensure that potential contamination of soils will be minimized. In the event of spillage, the contaminated soil must be removed off-site or rehabilitated where possible. • The management system will include storage of flammable liquids and chemicals procedure (including MSDS);	Environmental manager and specialist contractor.	Throughout life of mine and in the event of spillage.	Low	Low	No additional cost	

				Operational Phase							
Activity		Impact Ref No.	Activity and Impact Description		Mitigation	Responsible Person	Frequency/ Duration	Significance Rating		Financial Plan	
No	Description		Affected Environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent	Final
					• Hazardous materials spill procedure; and emergency response procedure.						
		26.2	Land capability	Reduction in land capability due to soil contamination due to hydrocarbon spillage and leaks.	• A hydrocarbon management system will be introduced on site to ensure that potential contamination of soils will be minimized. In the event of spillage, the contaminated soil must be removed off-site or rehabilitated where possible. • The management system will include storage of flammable liquids and chemicals procedure (including MSDS); H • azardous materials spill procedure; and emergency	Environmental manager and specialist contractor.	Throughout life of mine and in the event of spillage.	Low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					response procedure.						
		26.3	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to pollutant and toxicant spillage and leaks may impact negatively the water resources.	• An equipment management system will be introduced and operated for the life of mine. • This will ensure the proper maintenance of all equipment to prevent the potential pollution of the water resource	Environmental coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	

				Operational Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		26.4	Surface water	The maintenance of equipment could result in diesel and oil spillages. If not captured the associated water could negatively impact on water resources	• Wash bays and maintenance/mechanical workshop areas must be bunded and placed on a hard park area. • The associated water must go through an oil trap prior to being sent to pollution control facilities. • All applicable DWAF Best Practice Guidelines for surface water management must be complied with and in particular Water management measures should be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A5: Water Management for Surface Mines (July 2008).	Environmental manager and specialist contractor.	Throughout life of mine and in the event of spillage.	Medium-high	Medium-low	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
27	Rehabilitation as mining progresses	27.1	Soils	Replacement of soil as part of rehabilitation. Positive impact.	• During rehabilitation, topsoil will be replaced in consolidated blocks and to the recommended depth. • Topsoil must be replaced at a minimum depth of 300mm. In areas demarcated as moderate agricultural potential topsoil must be replaced between a depth of 600mm to 900mm and for grazing 300mm to 600mm. • Quality testing on soil used for rehabilitation must be undertaken to determine fertility and acidity.	Environmental manager	During rehabilitation	Medium-high	Medium-high	No additional cost	
		27.2	Soils	Compaction of soil during replacement.	• Soil compaction will be minimize by dumping sufficient soil per square unit to allow a once-off levelling on top, which will prevent compaction lower down in the soil profile.	Environmental manager	During rehabilitation	Medium-low	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		27.3	Land capability	Restoration of land capability as part of soil replacement and rehabilitation. Positive impact.	• During rehabilitation, topsoil will be replaced in consolidated blocks and to the recommended depth. • Topsoil must be replaced at a minimum depth of 300mm. In areas demarcated as moderate agricultural potential topsoil must be replaced between a depth of 600mm to 900mm and for grazing 300mm to 600mm. • Quality testing on soil used for rehabilitation must be undertaken to determine fertility and acidity.	Environmental manager	During rehabilitation	Medium-low	Medium-low	No additional cost	
		27.4	Land use	Gradual return of land use from mining to pre-mining land uses. Positive impact.	• Rehabilitation must to be of a minimum of grazing land use..	Environmental manager	During rehabilitation	Medium-low	Medium-low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		27.5	Sensitive landscape (Wetlands)	Catchment area will be restored to near original size. Wetland areas will be resorted and surface and sub-surface flow dynamics restoration and ecological functioning of the wetland replaced	• Increase in catchment area and restoration of wetland soil profiles which will restore surface and sub-surface flow dynamics. Thus restoring ecological services	Environmental co-coordinator	Throughout operational phase	Medium-low	Medium-low	No additional cost	
		27.6	Air Quality	Replacement and compaction of soil will positively impact on dust fallout levels	• Soil compaction will be minimize dust fallout levels due to the compacted soil particles not being vulnerable to being swept up by wind. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. • The limit value for the yearly average for PM10 is 40ug/m^3	Environmental manager	During rehabilitation	Medium-low	Low	R65 000	R455 000

				Operational Phase						
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		27.7	Natural environment	Rehabilitation will improve the growth of natural vegetation and limit the erosion	• Once topsoil has been place on the area seeding must be undertaken as soon as possible with grasses such as A standard seed-mix is 5 kg/ha of Smuts finger grass (Digitaria eriantha), 5 kg/ha of Rhodes grass (Chloris gayana) and 5 kg/ha of teff (Eragrostis tef). A second option is 10 kg/ha of love grass (Eragrostis curvula) and 5 kg/ha of teff. Any alien invasive species that establish them selves in rehabilitated areas must be removed. • If compaction occurs it must be ripped to encourage plant growth. Rehabilitated areas must be monitored and maintaining to prevent soil erosion as stipulted in the rehabilitation plan that is	Environmental co-coordinator	During rehabilitation	Medium-low	Low	Continuous rehabilitation will be done during the operational phase - Cost per m3 = R 15.44	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					compiled as part of the closure plan for the mine.						
		27.8	Fauna (mammals, birds, reptiles, insects)	Rehabilitation could increase the natural habitat and thereby increase the animals influx back to their habitats	• The rehabilitation plan must be adhered to as mining progresses to ensure the creation of habitats.	Environmental co-coordinator	During rehabilitation	Medium-low	Low	No additional cost	

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		27.9	Surface water	Decant - There is a possibility of water affected by AMD to decant from in-pit areas to surface water. The AMD could be transported off site and will affect surface water quality on an international scale.	• When designing and mining opencast areas, the final decant point will, as far as possible, be kept above the level of spoil replacement. • This is done in an effort to ensure that replaced spoils are completely flooded when groundwater levels recover to reduce the contact of spoils with air in an effort to reduce oxidation. • During rehabilitation, the contouring of the surface will be such as to avoid ponding of water on rehabilitated surface to reduce the infiltration of water into areas where spoils have been replaced and which are prone to AMD. • Water entering the pit during the operational phase should be pumped out as rapidly as	Environmental co-coordinator	throughout the life of mine	High	Medium-high	R 46 240	R 323 680

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					possible to minimize its contact with AMD generating material. • This water should be treated and either used on site, or discharged if quality is such that it meets discharge permit conditions. • All applicable DWAF Best Practice Guidelines for surface water management must be complied with and in particular Water management measures should be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A5: Water Management for Surface Mines (July 2008).						

				Operational Phase							
Activity		**Impact Ref No.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		27.10	Surface water	Rehabilitation by means of backfilling will result in the alteration of flow dynamics and natural drainage lines. if topsoil is not vegetated this could result in soil erosion and subsequent siltation of the water resources.	• It is important to ensure that natural drainage lines are restored during the rehabilitation process. • The topsoil cover must be vegetated to prevent soil erosion and siltation. • All applicable DWAF Best Practice Guidelines for surface water management must be complied with and in particular Water management measures should be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A5: Water Management for Surface Mines (July 2008).	Environmental co-coordinator	During rehabilitation	Medium-high	Medium-low	R 46 240	R 323 680

Decommissioning Phase

Decommissioning Phase											
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
1	Removal of all infrastructure	1.1	Soils	Compaction of soil due to movement of heavy vehicles using during removal of infrastructure.	• Heavy vehicles should be restricted to roads and areas where infrastructure is to be removed.	Environmental manager and contractor	Throughout decommissioning phase	Medium-low	Medium-low	No additional cost	
		1.2	Sensitive landscape (Wetlands)	Potential pollution of surface water resources due to the removal of management facilities from spills and leaks may impact negatively on the water resources.	• Decommissioning to take place during the dry season or during periods of low rainfall. • Vehicles to make use of existing roads. All mining vehicles to be maintained to prevent spillages and leaks into the water resources.	Environmental co-coordinator	Throughout decommissioning phase	Medium-low Positive	Medium-low	No additional cost	

			Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					• Prevent vehicles/activities from impacting on areas previously unexpected.						
		1.3	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Decommissioning activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust	Environmental manager and / or contractor	Throughout decommissioning phase	Low	Low	No additional cost	

			Decommissioning Phase								
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					mufflers.						
		1.4	Natural environment	Heavy trucks could destroy the vegetation	• Heavy vehicles will be restricted to areas where infrastructure is to be removed.	Environmental co-coordinator	Throughout decommissioning phase	Low	Low	No additional cost	
		1.5	Fauna (mammals, birds, reptiles, insects)	Potential destruction of small mammals' habitats when infrastructures are removed.	• Heavy vehicles will be restricted to areas where infrastructure is to be removed.	Environmental co-coordinator	Throughout decommissioning phase	Low	Low	No additional cost	
		1.6	Visual	The removal of infrastructure will improve the visual aesthetic of the area.	• Ensure all infrastructure is removed from the project site and that disturbed areas are rehabilitated and vegetated.	Environmental co-coordinator	Throughout decommissioning phase	Medium-low Positive	Medium-low	No additional cost	

			Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
2	Increased vehicle and heavy machinery movement to dismantle and remove infrastructure	2.1	Surface water	Hydrocarbon pollution from petrol and diesel spillages from vehicles and heavy machinery. Siltation of surface water resources from dust created when moving soils. Accidental spillages of chemicals.	• All vehicles must be fitted with leak trays to contain potential spills of hydrocarbons and other chemicals. • The trucks must be covered when carrying material that can create dust. • The roads need to be wet to prevent dust formation. • The transportation, loading and storage of hydrocarbons and chemicals should be in accordance with legislation and SANS codes.	Environmental co-coordinator	Throughout decommissioning phase	Medium-low	Low	R 46 240	R 323 680
3	Filling of final void	3.1	Sensitive landscape (Wetlands)	Restoration and rehabilitation of sub-surface and surface flow dynamics. This is only	• The soil profile will be rehabilitated to allow for restoration of sub-surface flow dynamics. • Soils not to be excessively	Environmental co-coordinator	Throughout decommissioning phase	Medium-high	Medium-high Positive	No additional cost	

			Decommissioning Phase								
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				achieved if soils are separately correctly and managed and the original soil profile is restored.	compacted which will prevent sub-surface flow and filtration of water. • Topography to be restored to the original form to restore surface flow dynamics.						
		3.2	Air Quality	The activities regarding the backfilling of the final void will generate dust and impact on the dust fallout levels, as well as the levels of particulate matter (PM10)	• When filling of final void , dedicate a water truck or large hose the filling equipment and operations and apply water as needed; or, cover or enclose stationary backfill material; • If needed, mix backfill soil with water prior to moving. Empty loader buckets slowly and minimize their drop heights.	Environmental manager and / or contractor	Throughout decommissioning phase	Medium-low	Low	No additional cost	

				Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					Immediately after backfilling, apply soil stabilization compounds to form a crust. • The limit value for the 24 hour average for PM10 is 75 ug/m^3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m^3						
		3.3	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Decommissioning activities will be limited to daytime hours.	Environmental manager and / or contractor	Throughout decommissioning phase	Low	Low	No additional cost	

				Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					• Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.						
		3.4	Visual	Replacement of overburden and top soil will improve the visual aesthetic of the project site, thus decreasing the visual impact.	• Ensure final replacement of overburden and top soil follows the original topography prior to disturbance.	Environmental co-coordinator	Throughout decommissioning phase	Medium-low Positive	Medium-low	No additional cost	
		3.5	Surface water	Dust from transporting of and during back filling (of final void) with	• Dust formation should be prevented by covering the trucks carrying the overburden to fill the opencast void,	Environmental co-coordinator	Throughout decommissioning phase	Medium-high	Medium-low	R 46 240	R 323 680

			Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				the stored stockpile, Alteration of the free drainage system (natural flow of water). There might be impacts created by the presence of PCD if not maintained there could be loss of capacity from siltation and subsequent overflow to the receiving environment where surface water resources can be impacted upon.	the roads must be wet as well. • The filling of the void must be controlled to maintain the correct slopes so as to prevent the alteration of a free drainage system, where there was initially a natural drainage line. • The water from the PCD should be treated to levels that can be discharged to a municipal system or nearby rivers (this must be a registered water activity). • Decommissioning activities must be conducted in accordance with DWAF best Practice						

					Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					Guidelines: A5 Water Management Aspects for Mine Closure (December 2008).						
		3.6	Groundwater	Increase in recharge	• Slope all areas to be free draining and re-vegetate. • Decommissioning activities must be conducted in accordance with DWAF best Practice Guidelines: A5 Water Management Aspects for Mine Closure (December 2008).			Medium-high Positive	Medium-low	R 46 240	R 323 680
4	Spreading of sub-soils and topsoil	4.1	Soils	Positive impact. Replacement of soil as part of rehabilitation.	• During rehabilitation, topsoil will be replaced in consolidated blocks and to the recommended depths. • Topsoil must be	Environmental manager	During rehabilitation	Medium-high Positive	Medium-high	No additional cost	

				Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					replaced at minimum depths of 600 - 900 mm in areas demarcated as moderate agricultural potential and grazing 300mm to 600mm. • Quality testing on soil used for rehabilitation must be undertaken to determine fertility and acidity.						
		4.2	Soils	Compaction of soil during spreading.	• Soil compaction will be minimize by dumping sufficient soil per square unit to allow a once-off levelling on top, which will prevent compaction lower down in the soil profile.	Environmental manager	During rehabilitation	Medium-low	Medium-low	No additional cost	

Decommissioning Phase										
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		4.3	Land capability	Positive impact. Restoration of land capability as part of soil replacement and rehabilitation.	• During rehabilitation, topsoil will be replaced in consolidated blocks and to the recommended depth. • Topsoil must be replaced at a minimum depth of 300mm. In areas demarcated as moderate agricultural potential topsoil must be replaced between a depth of 600mm to 900mm and for grazing 300mm to 600mm. • Quality testing on soil used for rehabilitation must be undertaken to determine fertility and acidity.	Environmental manager	During rehabilitation	Medium-low Positive	Medium-low	No additional cost	

Decommissioning Phase										
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		4.4	Land use	Positive impact. Gradual return of land use from mining to proportional arable and grazing pre-mining land uses.	• Areas of disturbance will be rehabilitated proportionate to pre-mining land use, for example moderate agricultural potential and grazing..	Environmental manager	During rehabilitation	Medium-low Positive	Medium-low	No additional cost	
		4.5	Sensitive landscape (Wetlands)	Restoration and rehabilitation of sub-surface and surface flow dynamics. This is only achieved if soils are separately correctly and managed and the original soil profile is restored.	• The soil profile will be maintained to allow for restoration of sub-surface and surface flow dynamics. • The topography should be rehabilitated to or as close as possible to the original form to restore surface flow dynamics as well as ecological functioning of the wetland units.	Environmental co-coordinator	Throughout decommissioning phase	Medium-high Positive	Medium-high	No additional cost	

			Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		4.6	Noise	Construction activities, including the movement of machines will affect noise levels in the area negatively	• Noise monitoring must be undertaken in accordance to Section 16 of the EIA Report. • Switching off equipment when not in use. Decommissioning activities will be limited to daytime hours. • Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers.	Environmental manager and / or contractor	Throughout decommissioning phase	Low	Low	No additional cost	
		4.7	Air Quality	The spreading of sub soils and topsoil's will	• When spreading the soils, pre-wet surface soils in the operation area;	Environmental manager and / or	Throughout decommissioning phase	Low	Low	No additional cost	

			Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				disturb the soil particles. The disturbed particles could be picked up and transported by the wind as dust	stabilize surface soil with the use of water or dust palliative to form a crust on soil immediately following spreading.	contractor					
		4.8	Natural environment	Spreading of sub-soil and topsoil would restore the vegetation	• during rehabilitation, topsoil will be placed according to the recommended soil profiles and specifications as stated in the rehabilitation plan which is part of the mine closure plan	Environmental co-coordinator	Throughout decommissioning phase	Low	Low	No additional cost	
		4.9	Visual	Replacement of overburden and top soil will improve the visual aesthetic of the project site, thus	• Ensure final replacement of overburden and top soil follows the original topography prior to disturbance.	Environmental co-coordinator	Throughout decommissioning phase	Medium-low Positive	Medium-low	No additional cost	

			Decommissioning Phase								
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				decreasing the visual impact.							
		4.10	Fauna (mammals, birds, reptiles, insects)	Spreading of sub-soil and topsoil would restore the vegetation and the habitats of animals	• During rehabilitation, topsoil will be placed according to the recommended soil profiles and specifications as stated in the rehabilitation plan which is part of the mine closure plan	Environmental co-coordinator	Throughout decommissioning phase	Low Positive	Low	No additional cost	
		4.11	Surface water	Siltation from dust, hydrocarbon contamination form petrol and diesel spillages and accidental spillages from other chemicals.	• Road wetting, hydrocarbon and other chemicals management systems in accordance with SANS codes.	Environmental co-coordinator	Throughout decommissioning phase	Low	Low	R 46 240	R 323 680

				Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		4.12	Groundwater	Backfilling and compacting overburden and soil will prevent infiltration and the formation of AMD	• Ensure that rehabilitation is done properly in accordance to the rehabilitation plan as part of the mine closure plan.	Engineer and environmental coordinator	Throughout decommissioning phase	Medium-low	Medium-low	R 46 240	R 323 680
5	Re-vegetation of disturbed areas	5.1	Soils	Positive impact. Vegetation stabilises soil particles and promotes cohesion, preventing soil erosion.	• Vegetation must be replaced as soon as possible after topsoil replacement using area specific species in order to prevent soil erosion.	Environmental Manager	During rehabilitation	Medium-high Positive	Medium-high	Dependent on number and size of topsoil stockpiles, however, a cost of R 15.25/m3 has been estimated for vegetation	
		5.2	Land capability	Positive impact. Vegetation stabilises soil particles and promotes cohesion,	• Vegetation must be replaced as soon as possible after topsoil replacement using area specific species in order to prevent soil erosion.	Environmental Manager	During rehabilitation	Medium-low Positive	Medium-low	No additional cost	

			Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				contributing to the restoration of pre-mining land capability.							
		5.3	Sensitive landscape (Wetlands)	The erosion potential of vegetated areas is reduced as well as runoff potential reduced. This will allow for infiltration of the vegetated areas, contribution to sub-surface flow dynamics.	• Surface water velocity is reduced which will allow the water to infiltrate into the soil profile and the wetland soil will enhance the quality of available water for the system and limit erosion of the re-vegetated areas.	Environmental co-coordinator	Throughout decommissioning phase	Medium-high	Medium-high	No additional cost	
		5.4	Air Quality	Vegetation stabilises soil particles and promotes cohesion.	• Re-vegetation prevents soil erosion and consequently preventing windblown dust particles.	Environmental manager and / or contractor	Throughout decommissioning phase	Medium-low	Medium-low	R65 000	R455 000

			Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		5.5	Natural environment	Re-vegetating areas will improve the natural environment	• once topsoil has been place on the area seeding must be undertaken as soon as possible with grasses such as a standard seed-mix of 5 kg/ha of Smuts finger grass (Digitaria eriantha), 5 kg/ha of Rhodes grass (Chloris gayana) and 5 kg/ha of teff (Eragrostis tef). A second option is 10 kg/ha of love grass (Eragrostis curvula) and 5 kg/ha of teff. Any alien invasive species that establish themselves in rehabilitated areas must be removed. • If compaction occurs it must be	Environmental co-coordinator	During rehabilitation	Medium-low	Low	Dependent on number and size of topsoil stockpiles, however, a cost of R 15.25/m^2 has been estimated for vegetation	

				Decommissioning Phase						
Activity		Impact Ref no.	Activity and Impact Description		Mitigation	Responsible Person	Frequency/ Duration	Significance Rating		Financial Plan	
No	Description		Affected Environment	Impact	Management/Mitigation Measure			Before Mitigation	After Mitigation	Concurrent	Final
					ripped to encourage plant growth. • Rehabilitated areas must be monitored and maintaining to prevent soil erosion as stipulated in the rehabilitation plan that is compiled as part of the closure plan for the mine.						
		5.6	Fauna (mammals, birds, reptiles, insects)	Re-vegetating areas will improve the natural habitats	• The rehabilitation plan must be adhered to as mining progresses to ensure the creation of habitats.	Environmental co-coordinator	During rehabilitation	Medium-low	Low	No additional cost	
		5.7	Visual	Re-vegetation of mining areas will improve the visual aesthetic of the project site, thus decreasing the visual impact.	• Ensure vegetation utilised for rehabilitation is indigenous to the area.	Environmental co-coordinator	During rehabilitation	Medium-low Positive	Medium-low	No additional cost	

					Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		5.8	Surface water	Re-establishment of the original (pre-mining) catchment and drainage characteristics of the mine site.	• Based on the initial profile of soil pre-mining, the backfilling process much aim to achieve the same profile, the backfilled area must be vegetated and continuously monitored.	Environmental co-coordinator	During rehabilitation	Medium-low Positive	Low	R 46 240	R 323 680
6	Profiling and contouring of the area to preserve natural drainage lines	6.1	Soils	Positive impact. Restoration of natural drainage lines will prevent water logging and consequent subsidence of replaced soil.	• No mitigation required.	Environmental Manager	During rehabilitation	Medium-high Positive	Medium-high	No additional cost	
		6.2	Land capability	Positive impact. Prevention of water logging and subsidence	• No mitigation required.	Environmental Manager	During rehabilitation	Medium-low Positive	Medium-low	No additional cost	

					Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				maximises the long-term land capability.							
		6.3	Sensitive landscape (Wetlands)	Restoration and rehabilitation of drainage lines, seepage areas to restore the original surface flow dynamics.	• Contours will be created to match the original contour profiles for the area. • This will attempt to recreate surface flow dynamics and seepage areas for wetlands	Environmental co-coordinator	Throughout decommissioning phase	Medium-high Positive	Medium-high	No additional cost	
		6.4	Noise	Machinery active during these activities will generate noise	• Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers; • Switching off equipment when not in use;	Environmental manager and / or contractor	Throughout decommissioning phase	Low	Low	No additional cost	

					Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					• Decommissioning activities will be limited to daytime hours A Noise Monitoring Programme should be implemented during this phase						
		6.5	Natural environment	Contouring of the area will prevent soil erosion and water run-offs	• Contours must be created to match the original contour profiles for the area. A • lien plants will be removed.	Environmental co-coordinator	During rehabilitation	Medium-low	Low	No additional cost	
		6.6	Fauna (mammals, birds, reptiles, insects)	Contouring of the area will prevent soil erosion and water run-offs	• Contours will be created to match the original contour profiles for the area.	Environmental co-coordinator	During rehabilitation	Medium-low	Low	No additional cost	
		6.7	Visual	The profiling of the area will improve the visual aesthetic of the project	• Ensure profiling follows the original topography prior to disturbance.	Environmental co-coordinator	During rehabilitation	Medium-low Positive	Medium-low	No additional cost	

				Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				site, thus decreasing the visual impact.							
		6.8	Surface water	Where natural drainage lines are restored there will be a positive gain in the catchment	• Contours should be matched to those pre-mining.	Environmental co-coordinator	During rehabilitation	Medium-low Positive	Low		
		6.9	Topography	Topographical contours and drainage line will be restored.	• Contours will be created to match the original contour profiles for the area.	Environmental co-coordinator	During rehabilitation	Medium-low Positive	Low		
7	Environmental monitoring of decommissioning activities	7.1	Sensitive landscape (Wetlands)	An aquatic bio monitoring programme will monitor potential impacts to the immediate aquatic surface ecosystem and where needed,	• This will allow for the determination of spatial and temporal trends regarding the integrity of the system. • This will identify any long term impact to the system.	Environmental co-coordinator	Throughout decommissioning phase	Medium-low Positive	Medium-high	No additional cost	

				Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				corrective action taken and rehabilitation measures implemented.	• The bio monitoring programme should be initiated before mining commences and is described according to the DWAF Best Practice Guidelines (G3: Water Monitoring).						
		7.2	Air Quality	A dust fallout monitoring programme will monitor dust fallout levels during the decommissioning phase .	• The monitoring programme will assess whether the rehabilitation methods are effective in reducing dust fallout levels caused by the mining activities. PM 10 levels must be monitored	Environmental manager and / or contractor	Throughout decommissioning phase	Medium-low	Medium-low	R65 000	R455 000
		7.3	Noise	A noise monitoring programme will monitor ambient noise	• The monitoring programme will assess whether the noise levels caused by the operational phase have reduced,	Environmental manager and / or contractor	Throughout decommissioning phase	Medium-low	Medium-low	No additional cost	

				Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
				levels during the decommissioning phase .	as well as assess whether the decommissioning phase is impacting on the ambient noise levels.						
		7.4	Natural environment	Monitoring will increase the natural vegetation	• An alien invasive species management programme must be implemented. In the event of signs initial erosion, erosion prevention methods must be implemented.	Environmental coordinator	During rehabilitation	Medium-low	Low	R50 000	R 350 000
		7.5	Fauna (mammals, birds, reptiles, insects)	Monitoring will increase the natural habitats of animals	• An alien invasive species management programme must be implemented. In the event of signs initial erosion, erosion prevention methods must be implemented.	Environmental coordinator	During rehabilitation	Medium-low	Low		

			Decommissioning Phase							
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
		7.6	Surface water	Monitoring will detect any negative impacts on surface water resources.	• Monitoring will enable implementation of mitigation measures where surface water impacts are detected. • Surface water monitoring must be conducted in accordance with DWAF best Practice Guidelines: A5 Water Management Aspects for Mine Closure (December 2008).	Environmental coordinator	during and after rehabilitation	Medium-low	Medium-low	R 46 240	R 323 680
		7.7	Groundwater	Failure to manage contaminated groundwater, uncontrolled decant of poor quality water	• Ensure planning is adequate; ensure funds for monitoring post closure, initiate water containment or treatment as final options. • Groundwater monitoring must be	Engineer and environmental coordinator	During rehabilitation phase	Medium-high	Medium-low	R 46 240	R 323 680

				Decommissioning Phase						
Activity		**Impact Ref no.**	**Activity and Impact Description**		**Mitigation**	**Responsible Person**	**Frequency/ Duration**	**Significance Rating**		**Financial Plan**	
No	**Description**		**Affected Environment**	**Impact**	**Management/Mitigation Measure**			**Before Mitigation**	**After Mitigation**	**Concurrent**	**Final**
					conducted in accordance with DWAF best Practice Guidelines: A5 Water Management Aspects for Mine Closure (December 2008).						

2.6.3 Environmental monitoring and performance assessments

2.6.3.1 Air quality

Objectives

A baseline dust assessment was performed from October 2008 to June 2009, which was included in the EIA/EMP. The proposed air quality monitoring programme will allow for the monitoring of dust fallout of which the dust fallout will be analyzed for its weight characteristics and will go through a 30 element ICP scan. The monitoring programme will also allow for the monitoring of particulate matter smaller then 10 micrometers (PM10). A PM10 sampler will be used to take 24hr readings (once monthly at every relevant receptor) which can then be compared with the 24hr limit standards for PM10 according to the National Environmental Management Air Quality Act no 39 of 2004 (NEMAQA). After a period of 12 months the annual average can then be compared with the annual average limit according to NEMAQA.

The primary aim of the dust monitoring programme is to measure the impact of the proposed mining operation on the dust levels especially PM10 levels which pose a health risk. The objective is to ensure that no receptors are significantly impacted, and if impacts do occur to alert management to this fact in order for them to action additional mitigation measures.

Positioning of samplers

The positions of the samplers (dust fallout as well as PM10) are essential to the interpretation of the results, and needs to take into account the surrounding sensitive receptors, historical directional wind data for the area, and topographical features that may affect the wind direction.

Before the samplers are erected on site the area is surveyed using topographical maps and historical climate data to determine the various wind flow patterns and topographical features that may influence the migratory patterns of fallout dust on site. Once these factors have been determined the location of the dust buckets as well as the PM10 sampler is pinpointed taking into consideration the position of various sensitive receptors.

For the single dust fallout samplers, the buckets are filled with distilled water and left out on site for a period of 30 days (+/- 3 days); according to SANS:1929; from there the buckets will be transported to a reputable Laboratory for analysis. As for the PM10 sampler, the sampler is left at each relevant receptor point for a period of 24 hrs once monthly through out the life of mine.

Table 59 represents the relevant receptors where monitoring is to take place.

Table 59: Receptor points where dust fallout and PM10 monitoring is to take place.

ID	X	Y	Owner	Reason
WD1	30.034179	-25.766317	Mrs Lotter	Sensitive Receptor
WD2	30.045977	-25.790865	Mr Potgieter	Sensitive Receptor
WD3	30.038270	-25.789001	Mr Kotze	Sensitive Receptor
WD4	29.999710	-25.760430	Mr Viljoen	Sensitive Receptor
WD5	29.992647	-25.782140	Mr Gerrits	Sensitive Receptor
WD6	30.011520	-25.788673	Mr Pretorius	Downwind, Sensitive Receptor

Frequency

The air quality monitoring programme should initiate as soon as construction commences, the buckets should be changed on a monthly basis and the PM10 monitor should monitor PM10 levels for a 24hr period at each receptor once monthly at each receptor. The monitoring programme should continue through out the life of mine.

Incident reports will be submitted to the mine as well as to the relevant competent authority upon receipt of results exceedences. In case of no exceedance this will be confirmed.

Methodology

All dust fall out samples will be taken in accordance to the SANS 1929:2005 guidelines until the air quality regulations for South Africa have been finalised, after which all sampling will be done according to these guidelines. The 24hr PM10 samples will be taken in accordance with the SANS 1929:2005 guidelines, but will be assessed according to the air quality standards of the NEMAQA (Act 39 of 2004)

Sample Submission

All the samples must be submitted to a reputable SANAS accredited laboratory with a quality management plan.

Analysis

For dust fallout analysis, the analysis of samples should take place within one week of collection to ensure the accuracy of the results. The sample bucket lids should not be removed at any stage after the lid has been placed on the bucket at the site until the samples have reached the laboratory. The PM10 measurements will be read off the data logger as soon as the PM10 meter measured for a 24hr period. The constituents to be analysed for are displayed in Table 60.

Table 60: Constituents to be analysed for:

Relevant Fall-out Per Bucket	Total Fall-out Per Bucket	PM10 (24hr analysis)
mg/m²/day	mg	μg/m^3

Data interpretation

In order to assess the results, the collected dust is filtered through a sub-micronic pre-weighed filter using a vacuum filter bench. Once the wet filtrate has been desiccated by evaporation of any retained moisture, the filter is reweighed to ascertain the collected mass (Insoluble particulate). The soluble particulate is assessed by evaporating the catch media and weighing the resulting solids. The filter is then sent through a 30 element ICP scan. As for the PM10 levels, they are assessed according to the ambient air quality standards of the NEMAQA (Act. 39 of 2004)

South African Fallout Dust Classification

Table 61: **Fallout dust classification as per the standards set by the Department of Environmental Affairs and Tourism (DEAT)**

S.A. Classification (DEAT)	mg/m²/day
Slight	<250
Moderate	251 – 500
Heavy	501 – 1200
Very heavy	>1200

Table 62: PM10 levels according to the ambient air quality standards (NEMAQA)

24hr Average ($\mu g/m^3$) The 24hr limit may not be exceeded by more then 3 times in a year	Annual Average ($\mu g/m^3$)
180	60

Table 63: Four-band scale evaluation criteria for dust deposition (After SANS 1929: 2004)

Band Number	Band Description Level	Dust fall rate (D) ($mg.m^2.day$, 30 day average)	Comment
1	Residential	D < 600	Permissible for residential and light commercial.
2	Industrial	600 < D <1,200	Permissible for heavy commercial and industrial.
3	Action	1,200 < D <2,400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	Alert	2,440 < D	Immediate action and remediation required following the first incidence of dust fall rate being exceeded. Incident report to be submitted to the relevant authority.

Table 64: Target, action and alert thresholds for dust deposition (After SANS 1929: 2004)

Level	Dust fall rate (D) ($mg.m^2.day$, 30 day average)	Averaging Period	Comment
Target	300	Annual	N/A

Action Residential	600	30 days	Three within any year, no two sequential months.
Action Industrial	1200	30 days	Three within any year, not sequential months.
Alert Threshold	2,400	30 days	None. First incidence of dust fall rate being exceeded requires remediation and compulsory report to the authorities.

These dust fall-out guidelines are descriptive without giving any guidance for action or remediation. On the basis of the cumulative South African experience of dust fall-out measurements, Standards South Africa have published two important new standards in terms of air quality underlying limits for dust fall-out rates. In terms of dust deposition standards, a four-band scale evaluation is used as well as target, action and alert thresholds.

Units are monitored monthly, the results are then analysed and placed into various graphs and tables that best indicate the dust fallout situation on site.

Reporting

A report is then compiled every three months detailing all findings and includes a full assessment of the results along with conclusions and recommendations for future monitoring on site. These reports should highlight any negative impacts on the air quality due to the mining operations as well as determine the sources of the impacts. The reports will discuss possible actions which can be used to mitigate any negative impacts. Relevant results will be graphed so that trends may be visually observed.

Duration

The programme will be implemented on a monthly basis for the life of the mine. This will only be altered if the sampling data indicates that either more or less sampling is to take place. The programme will be reviewed on an annual basis.

2.6.3.2 Hydrological

An environmental monitoring programme has to be put in place for the assessment and management of impacts on the environment that could result from the mining activities.

Objectives

To monitor any possible pollution from the mine operations through continuous measurement of water quality

Monitoring Locations

Surface water monitoring will be done at strategic locations as follows:-

- Upstream from the mining works;
- Downstream of possible sources of pollution e.g. downstream of the decant points of both the North and South pits;
- Downstream of a stockpile area;
- Downstream of the pits to establish a possibility of any pollution to the streams;
- Downstream of infrastructure that could be possible sources of surface water pollution such as the hydrocarbons storage facilities; and

The surface water points sampled during the hydrocensus (Plan 11).

Frequency

- Sampling will be conducted on a monthly basis during the first year to establish seasonal trends
- After the first year of mining, sampling will be conducted quarterly.

Monitoring Data Handling

Water quality will be the main item that will be monitored by the surface water monitoring programme. Fluctuations in water quality will assist in identifying and informing reviews of management plans and mitigation measures. Samples will be submitted to a reputable laboratory for water quality analysis. A full analysis report on the quality of the water will be submitted to the mine management on an annual basis.

2.6.3.3 Geohydrological Monitoring Programme

Objective

To monitor groundwater quantities and qualities to understand the current baseline conditions and to identify future impacts from mining operations on the groundwater systems.

Monitoring point locations

Groundwater monitoring points are not yet in place at Weltevreden and only domestic boreholes were sampled during the hydrocensus. However Weltevreden is in the process of developing a Groundwater Monitoring Plan if the mining right is approved. The Groundwater Monitoring Plan will discuss current and future monitoring systems that will include geophysical studies and a drilling programme to implement the monitoring system.

Both surface and groundwater will be monitored from boreholes, streams and pans located in the vicinity of the mining area. The samples will be submitted to a reputable laboratory for analysis and the results included in a report.

Monitoring Frequency

- Sampling of the boreholes and springs will be conducted on a monthly basis during the first year to establish trends
- After the first year of mining, sampling will be conducted quarterly.

Monitoring Data Collected

Both water quality and quantity will be the main items that will be monitored by the geohydrological monitoring programme. Groundwater quality will be monitored through among others the water level fluctuations to establish and mitigate any possible aquifer dewatering impacts in the area. Fluctuations in water quality will assist in identifying and informing reviews of management plans and mitigation measures. Samples will also be submitted to a reputable laboratory for water quality analysis. A full analysis report on the quality of the water will be submitted to the mine management on an annual basis.

2.6.3.4 Aquatic monitoring

In order to directly measure, assess and report on the current health status and long term trends of the state of the aquatic ecosystem associated with the activities assessed in the study area, the establishment of an aquatic monitoring programme is recommended. An additional purpose of a monitoring program can be to facilitate activities by obtaining and monitoring compliance of for water user licenses. These licenses relate to the legal requirement of water users to adhere to Source Directed Control (SDC) measures which are related to established Resource Quality Objectives according the aquatic reserve for catchments (National Water Act (Act 36, 1998)).

To ensure that the futures Resource Quality Objectives, to be designated for the catchment, are attained, it is recommended that a responsibility-driven approach towards the management of the aquatic ecosystem associated with the study area be followed. The purpose for such a monitoring strategy will be to examine the long-term environmental trends of the aquatic resources associated with the mining activities in a practical and achievable manner.

The proposed indices for the monitoring strategy include IHI, IHAS, SASS5, FAII, RVI and basic in situ water chemistry. In addition to this, toxicant screening should also be implemented and where toxicants are identified definitive analysis carried out. The frequency for such a monitoring programme should be implemented bi-annually during the construction and operation phase of the project, and then annually after closure of the mine until rehabilitation of the area is satisfactory. Thereafter, any non-compliance with the Resource Quality Objectives should be identified and mitigated accordingly.

In the unlikely event of any pollution event occurring it is strongly suggested that a Pollution Action Plan be implemented and the frequency of the monitoring strategy should be adjusted accordingly. This will help to identify the source of the event and mitigation can be formulated accordingly. It is strongly recommended that an assessment of the aquatic ecosystem be conducted as soon as possible after such an event. This will help to identify the magnitude and severity of such an event on the health of the aquatic ecosystem. A follow-up survey should be conducted approximately two months after the event in order to determine the effectiveness of the applied mitigation measures.

Plan 22: Environmental monitoring points

2.6.3.6 Vibration

It is recommended that a process of monitoring the blasting operations must be applied for all blasting to be done in the mine operation. This process should be to ensure that levels are within limits at all times. Early monitoring will also give indications of what ground vibrations levels are recorded at what distances and help with being proactive on the levels observed. It is proposed that at least four seismographs be placed at the positions as indicated on Plan 22.

PLAN 22

2.6.3.7 Noise

It is recommended that the monitoring plan be implemented to monitor the noise levels generated by the mining activities, to ensure the levels remain are below the SANS 10103:2008 noise limits. Components to be included in the proposed monitoring plan are discussed below:

Baseline noise monitoring is to be conducted on a quarterly basis for a period of twelve months. A report must be compiled quarterly and submitted to management to ascertain compliance with the required standards. Mine management should be advised of any significant increase in the ambient sound level as operations continue. The measurement points must take into account noise sensitive receptors, such as farmsteads, schools, hospitals, churches etc. only sensitive areas within a radius of two kilometres from the mining activities will be taken into account. The reason for the two kilometre buffer zone is because according to the Concawe method (SANS 10357) of calculating noise propagation, the specific noise levels produced by the heavy earth moving equipment and haul trucks that operate continuously will not impact beyond two kilometres. At each measurement point the ambient noise level will be sampled in terms of the following parameters:

The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point.

Measurements to be taken during both daytime (06:00 to 22:00) and the night time (22:00 to 06:00).

Requirements:

The blasting schedule for the proposed project is required to ensure that the measurements done through out the year can incorporate the noise levels generated by the blasting activities.

2.6.3.8 Soil and Vegetation Monitoring

Soil utilisation guide

The soil utilisation guide acts as guideline for the stripping, stockpiling and replacement of topsoil throughout the LOM. The objective is to minimise the impacts of mining on soil structure, depth and fertility, as well as post-mining land capability.

Stripping and stockpiling

The geographic location and extent of each soil type, wetland zones and wetland buffer zones should be surveyed and staked at 50 m intervals before any stripping commences. Soils should be stored on 4 stockpiles (see Plan 21) based on soil potential and soil type to prevent frequent soil variation and fragmented patterns with varying land capability after rehabilitation:

- Red well drained soils of soil type Hu2 should be stored on Stockpile 1;
- Yellow brown well- and moderately drained soils of soil types Cv1, Av1 and Gc2 should be stored on stockpile 2;
- Imperfectly drained soils of degraded temporary and seasonal wetland zones (soil types Dr1 and Lo1) should be stored on stockpile 3;
- Disturbance to Wetland soils of soil types Ka and Lo1 that should be minimised; and
- Shallow and stony soils of soil type Ms/R should be stored on stockpile 4.

Stockpiles should be located as far as possible on low potential soils or where it can serve as protection for wetland zones.

Plan 20 also illustrates the soil types within the proposed opencast area that should be stripped and stockpiled together as well as the area, stripping depth and available soil volume of each soil type. The figure further shows the positions, areas, dimensions and volumes of the stockpiles. The stockpile dimensions were calculated based on a square shape and will therefore somewhat exceed the indicated heights to compensate for sloped edges. The footprint sizes should remain the same as far as possible.

Should the topsoil be stored as a berm, the same stripping and stockpiling principle should be followed. Stockpiles should by no means be contaminated with coal, discard or overburden material.

Topsoil replacement

Proper stripping and stockpiling of the original soil types is the first key to proper rehabilitation which will enable the reconstruction of the pre-mining land capability as far as possible.

Proper shaping of the spoil layer to a freely drained surface and as close to the original topography as possible is the second key to proper rehabilitation. Failing in these two critical requirements will definitely adversely affect the post-mining land capability even with other rehabilitation requirements at its best.

The soils should be placed back in consolidated blocks with a pre-assigned land capability class for each block to prevent frequent varying depths which lead to small fragmented land capability units. The land capability class will be determined by the soil type and the thickness of the soil layer placed back on the spoil surface.

Plan 23: Soil utilization guide

Topsoil should be dumped in sufficient quantities to allow a once-off levelling on top to prevent compaction in the lower soil profile which cannot be alleviated with normal agricultural equipment. Topsoil should not be spread over distances with dozers and bowl scrapers should not be used.

The post-mining land capability classes in terms of soil depth are summarised in Table 65.

Table 65: Post mining land capability

Class	Soil depth
Arable (moderate to high agricultural potential)	> 900 mm
Arable (moderate agricultural potential)	600 – 900 mm
Grazing	300 – 600 mm
Wilderness	100 – 300 mm
Wetland	> 300 mm

The opencast area should be rehabilitated to the following proportions of land capability:

- Arable (moderate to high agricultural potential): 3.19 % (Soils on stockpile 1);
- Arable (moderate agricultural potential): 73.15% (Soils on stockpile 2);
- Grazing: 13.2% (Soils on stockpile 2);
- Wilderness: 0.94% (Soils on stockpile 4); and
- Wetland: 9.52% (Soils n stockpile 3).

Soils of stockpile 1 should be placed on the post-mining higher lying terrain units (crests and upper midslopes) and soils of stockpiles 2 and 4 below that on lower lying terrain units (mid- and lower midslopes). Soils of stockpile 3 soils should be placed in the post mining drainage zones.

The soil fertility status of the rehabilitated land should be determined and soil amelioration should be take place accordingly before re-vegetation takes place.

2.6.3.9 Vegetation

No Red Data plants were found and this study area is dominated by alien invasive species. When removing alien invasive species and weeds, care must be taken to eradicate the plants fully. According to the Conservation of Agricultural Resources Act (Act 43 of 1983) eradicate means to treat plants by any suitable method in order to prevent such plants from growing, multiplying and propagating. When removing plants from the site it should, therefore, be done at such a time when they are not producing seeds that could easily be spread by wind during cutting and transport. Plants that are known to grow back easily need to be uprooted in order to remove all possible avenues for re-growth and any juvenile plants spotted growing during the operation need to be removed before they become a problem.

2.6.3.10 Performance Assessments

Performance assessments will be conducted by professional consultants on an annual basis throughout the life of mine, to monitor the EIA and EMP process and the rehabilitation process and advice on any mitigation measures which need to be added to the existing programmes.

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

An assessment of compliance to applicable legislation will be included in the assessment and will take into consideration the management principals and strategies stated in the Environmental Management Programme, and assess whether this strategy is providing the required results. Any flaws found in the rehabilitation process will be included in the report along with the recommended mitigation measures.

A report will be compiled on an annual basis to mine management, who may then decide the appropriate actions to be taken, along with an updated financial provision

2.6.4 EMERGENCY RESPONSE PLAN

2.6.4.1 Objectives

In the event of an emergency, an emergency response plan must be consulted. This plan will be drawn up and placed around the mine where it will be easily viewed. The plan will contain evacuation routes and a list of emergency numbers. It is advisable that the mine tests the emergency response plan by running training and simulations, in order to identify any weaknesses.

Emergencies that have been listed here include: accidents, fires, hydrocarbon spillages and flooding.

If the emergency has potential to affect surrounding communities, they will be alerted via alarm signals or contacted in person. The surrounding community will be informed prior to mining taking place, of the potential dangers and emergencies that exist, and the actions to be taken in such emergencies.

Communication is vital in an emergency and thus communication devices, such as mobile phones, radio's, pagers or telephones, must be available around the mine. A checklist of emergency response participants must be consulted and the relevant units notified. In this case, many of the emergency services will be sourced from Belfast, Carolina and Middelburg, the nearest towns.

The checklist includes:

- fire department;
- police;
- emergency health services such as ambulances, paramedic teams, poisons centres;
- hospitals, both local and for evacuation for specialist care;
- public health authorities;
- environmental agencies, especially those responsible for air, water and waste issues;

- other industrial facilities in the locality with emergency response facilities;
- public works and highway departments, port and airport authorities; and
- public information authorities and media organisations.

2.6.4.2 Emergency situations

The following is a list of potential emergencies that could occur:

<u>Accidents</u>

In the case of a medical accident or problem, a first aid kit will be available on the mine.

A checklist of emergency response participants must be consulted and the relevant units notified. In this case, many of the emergency services will be sourced from the nearest main town, Middelburg.

<u>Fire</u>

Veld fires and fires resulting from other sources must be handled with extreme caution. Fire extinguishers will be placed around the mine.

Procedure:

- The alarm will be activated to alert occupants of the mine in the event of a fire;
- In the event of a small fire the fire extinguishers placed around the mine should be used to contain and extinguish the fire;
- In the event of a large fire, the local area council's fire department will be consulted; and
- All staff will receive training in response to a fire emergency on site.

<u>Hydrocarbon spillage</u>

Hydrocarbons such as diesel, petrol, and oil will be kept on site as fuel for the mine machinery. In the event of a spillage, procedures must be put into place to ensure that there are minimal impacts to the surrounding environment.

Procedure:

In the event of a small spillage, the soil will be excavated and treated;

- In the event of a large spillage, adequate emergency equipment for spill containment or collection such as additional supplies of booms and absorbent materials will be available and if required, a specialised clean up crew will be called in to decontaminate the area; and
- After a major spill water quality samples of any water sources utilised within 500m from the spill will be monitored for hydrocarbons for the next three months on a monthly basis and further remediation recommended based on the results thereof.

Flooding

There is potential for flooding during the rainy season, but particularly November to January when severe thunderstorms can occur. This could result in a large volume of water flowing downstream and could cause major damage to equipment and endanger the lives of employees on site. Heavy rainfall could also cause the pollution control dam to overflow and could flood mine workings. If this water leaves the sites is will enter water resources on site and cause contamination. Procedures must be put in place to ensure that there is a quick response to these events and damage is kept to a minimum.

Procedure:

- DWAF's flood warning system should be reviewed annually;
- The use of emergency pumps will occur if the water floods the pits, where it may be exposed to contamination; and
- Mine management should be made aware of any such event so they can take appropriate action to ensure production losses are kept to a minimum.

2.6.4.3 Implementation

All emergency response procedures will be implemented on the initiation of the construction stage. All employees of the Northern Coal Weltevreden mining operation will be trained in these procedures as part of the mine induction process. Northern Coal will ensure that all emergency numbers are located in various locations around the site and these locations are known to all employees for easy accessibility in the event of an emergency.

2.6.5 Waste management plan

Due to the nature of mining activities at Weltevreden, various types of wastes will be produced. In order to manage wastes in a manner that is environmentally sustainable, Northern Coal will develop a Waste Management Plan(WMP) that will be implemented in accordance with the requirements of NEMA, as well as Section 39(3)(d)(iii) of the MPRDA.

2.6.5.1 Background

The WMP is a working document and provides a guideline for the handling and management of waste. It will be necessary to review and revise the plan, once the construction activities, contractors and respective waste streams have been determined. Similarly, a revision of the WMP will be necessary for the operational phase and thereafter, an annual review will be conducted. Should there be substantial process or input changes, interim reviews and revisions may be required.

Although Northern Coal will not assume the responsibility for government waste management services, waste management assistance may be required.

2.6.5.2 Waste Management Objectives

The objectives of the WMP for Weltevreden are:

- To identify the sources of waste associated with the various phases of the project;
- To categorise the waste streams;
- To prevent pollution by minimising waste, substituting hazardous materials with non-hazardous materials, optimising container usage and recycling;
- To determine appropriate disposal methodologies for waste that cannot be prevented or recycled;
- To ensure waste management awareness among employees and contractors;
- To assign responsibility for implementing and enforcing the WMP; and
- To describe measures for the monitoring of waste management activities.

2.6.6 Health and safety management plan

The Health and Safety Management Plan (HSMP) serves as a guideline according to which health and safety issues associated with the Weltevreden mining project is managed. Once the construction activities and respective contractors have been determined and appointed, a HSMP will be developed. Similarly, a revision will be necessary for the operational phase and thereafter, an annual review will have to be conducted. Should there be substantial process changes, interim reviews and revisions may be required.

The HSMP plan is intended to highlight the potential health and safety impacts that may arise from the Project. It should be noted that the HSMP does not replace the Occupational Health and Safety Management System (OHSMS), which will be developed once a comprehensive risk assessment has been undertaken. Aspects to be considered during this risk assessment and an outline for the management system include:

- Transport of equipment;
- Transport of hazardous material;
- Transport of personnel;
- Moving machinery;
- Handling hazardous chemicals;
- Working at heights; and
- Pit wall stability.

2.6.6.1 Objectives

The objectives of the Weltevreden HSMP are:

- To commit to the achievement of a safe workplace;
- To undertake induction training, including safety training for all employees;
- To periodically inspect and establish procedures to eliminate or minimise unsafe conditions and actions;

- To provide a system for reporting accidents, on-the-job injuries and illnesses, as well as damage to property;
- To train employees in general safety and task assignments, first aid, mine rescue and accident investigation;
- To form a joint safety committee and MRTs;
- To hold safety/communication meetings for the different departments on a regular basis;
- To implement medical evacuation and contingency plans in the event of major medical emergencies; and
- To implement a crisis management plan for emergency response.

The Weltevreden HSMP will address hazards associated with construction activities and on-site contractor safety performance. Minimum health and safety performance standards will be written into contractors specifications. Continued re-enforcement, in the form of supervision and training, will be applicable to employees and contractors.

2.6.6.2 Chemical Storage

All chemicals should be grouped according to similar hazards such as flammability, corrosiveness, sensitivity to water/air and toxicity. Chemicals should be categorised and stored as flammables, oxidisers, and corrosives: acids and bases, highly reactive, extreme toxics and low hazards. Fire protection/response procedures will include isolation from ignition sources and storage in covered, vented facilities to keep materials away from sunlight and ambient heat. Chemicals must be stored at appropriate temperatures and humidity levels. The shelf-life expiration date of all chemicals should be noted. Gas cylinders must be securely strapped to a permanent structure e.g. a wall.

All chemicals are supplied with a Material Safety Data Sheet (MSDS), thus a quick method for determining whether the material is a fire hazard, health hazard or reactivity hazard. The MSD Sheets will be stored on site. It ensures that management and workers are knowledgeable of the hazards, protective measures and first aid associated with the stored chemicals.

2.6.6.3 Chemical Spillage

Spillages of chemicals/substances such as fuel, oils and other chemicals in the plant during operations are the most common incidents that are likely to occur on a mine site. The nature of the chemical spilled and the place where it occurred will determine the criteria of the incident and the subsequent response. The area where these chemicals and other substances are used and stored will be designed in such a way that all contaminated water or spillage will be contained in that area. Therefore, a spillage will be localised and will be contained within the immediate area resulting in a minor incident. All spillages need to be recorded. All hazardous material needs to be properly disposed of.

2.6.6.4 Hazardous Chemicals

Some chemicals such as elemental sulphur could result in a chemical fire. Chemicals fires pose a high health and safety risk to employees as well as to the biophysical environment. All fires need to be reported to the Control Room Coordinator immediately and all relevant documentation needs to be completed.

2.6.6.5 Chemical Fire Equipment

Equipment required for chemical fires include:

- Appropriate Personal Protection Equipment (glasses/goggles, masks, gloves and shoes);
- Fire extinguishers;
- Fire hydrants; and
- Fire retardant chemicals.

The measures that should be implemented to respond to a chemical fire incident are chemical specific. The responding team will refer to the relevant MSDS when attending to a chemical fire. Training should be provided for fire protection and prevention.

2.6.6.6 Blasting Material

An explosive magazine (dry, clean and ventilated) will be constructed for storage of blasting material. The storage and use of explosives will be under the strict control of a competent person. Logs or record books will be kept on the storage and issuance of explosives. Explosive storage and handling procedures developed in accordance with manufacturer recommendations and accepted safety practices will be applied. Smoking and open flames will be prohibited in the vicinity of the magazine and where explosives are transported, discharged and disposed of. Blasting warning systems will be installed to assist with safe blasting. People and property at risk from shock wave, noise, flying debris or dust/toxic emissions will be kept at appropriate distances. Handling procedures will be enforced and training will be provided to prevent injury resulting from explosive accidents.

3 COMPLIANCE WITH SECTION 39(4)(A)(II) – FINANCIAL PROVISION

“The applicant has complied with section 41(1)......an applicnt for a prospecting right, mining right or mining permit must before the Minister approves the enviromental management plan or envirometal management programme in terms of section 39(4), make prescribed financial provision for the rehabilitation or management of negative enviromental impacts”

3.1 CLOSURE OBJECTIVES

Mine closure is an ongoing programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post mining land users. The activities associated with mine closure are designed to prevent or minimise adverse long term environmental impacts, and to create a self sustaining natural ecosystem or alternate land use based on an agreed set of objectives. The objective of mine closure is to obtain legal (government) and community agreement that the condition of the closed operation meets the requirements of those entities, whereupon the companies’ legal liability is terminated.

Closure will include some form of rehabilitation. Rehabilitation can be divided into two different streams, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation must be carried out along with the operations on the coal mine, and will decrease the final liability that the mine will carry at the time of closure. This concurrent rehabilitation will be carried out within the context of the EMP. Final rehabilitation will be carried out once the mine goes into its closure phase. This final rehabilitation will be carried out within the context of the closure plan (Bailie, 2006).

The closure plan should be modified and adapted as the mining project continues and more knowledge is generated about the mine environment and the impacts of the project. Consequently a more detailed closure plan will be developed as more information is available.

A coal mine will obtain a closure certificate only once it can prove that rehabilitation is satisfactory, and that if any residual pollution effects exist they can be adequately managed. It is recommended that, whatever form of rehabilitation is used, a post-closure monitoring programme is implemented before the mine applies for closure (this should be for a period of 5 years, or until the long term trends of the impacts are understood). The institution of this monitoring programme will enable the mine to identify and rectify any residual pollution impacts.

The overall closure objectives for the Weltevreden project are as follows:

- Return land, mined by opencast methods, to a land capability similar to that which existed prior to mining and that the management level required to utilise the rehabilitated land is within the means of the farmer who uses it;
- Ensure that as little water as possible seeps out of the various sections of the mine and where this is unavoidable, to ensure that the water is contained or treated if the volume is significant and if it does not meet statutory water quality requirements;
- Remove all mine infrastructure that cannot be used by a subsequent land owner or a third party. Where buildings can be used by a third party, arrangements will be made to ensure their long term sustainable use;

- Clean up all coal stockpiles and loading areas and rehabilitate these to at least a grazing capability;
- Follow a process of closure that is progressive and integrated into the short and long term mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements;
- Form active partnerships with local communities to take of management of the land after mining, where possible; and
- To maintain and monitor all rehabilitated areas following re-vegetation or capping and, if monitoring shows that the objectives have been met, making an application for closure.

3.2 REHABILITATION PLAN

The mining method that will be undertaken in order to remove the coal seam will be truck and shovel roll over method at an average strip ratio of 5:1. Roll over mining or strip mining is undertaken by creating an initial cut or strip which is mined out. When mining moves forward to the second strip, the overburden from the second strip is backfilled into the initial cut. The overburden from the initial cut is used to backfill the final cut. An estimated 187.51ha will be disturbed. The opencast mining will be undertaken in three phases or sections which will result in the coal resource to be mined through three consecutive pits. Pit 1 will be done first; the direction of mining will be from the south-west towards the north-east as depicted by the arrow in Plan 22. As mining progresses in a north-easterly direction, the overburden from each new strip must be used to back-fill the previously mined void. This must be done until the last strip is mined out. Then the overburden from the first strip must be transported and filled into the last void. This will apply to Pit 2 and Pit 3. As each strip is filled, the soils must be replaced in horizons and re-vegetated. This concurrent rehabilitation must be carried out along with the operations on the mine, and will decrease the final liability that the mine will carry at the time of closure. Rehabilitation at closure will involve the removal of infrastructure and final rehabilitation of the mined out areas as per the closure plan.

Thus rehabilitation must be an ongoing process throughout the life of the mine, until finally the entire area is rehabilitated when mining concludes.

Action Points:

- Rehabilitate strips as they are filled;
- Rehabilitate soils;
- Re-vegetate strips;
- Shape mined out area to retain natural functioning of topography;
- Prevent soil erosion;
- Remove all mine infrastructure as per the closure plan;
- Clean up all coal stockpiles and loading areas and rehabilitate these to at least a grazing capability.
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Maintain and monitor all rehabilitated areas following re-vegetation or capping; and
- The rehabilitation plan should be updated annually.

Plan 24: Rehabilitation Plan

3.3 POST CLOSURE LAND USE

For the purposes of this plan, the final land use post-closure for the Weltevreden project at this stage is to return the land back to at least a land use capability of grazing or wilderness using the SA Chamber of Mines Guidelines. Although closure occurs once operations cease, rehabilitation measures should take place from as soon as construction commences and should continue through each phase of the project.

3.4 ACTIVITIES FOR CLOSURE

3.4.1 Stockpile areas

The objective is to ensure that the area is not a source of pollution after closure of the mine. This will be achieved by:

- Removal of all stockpiled coal from the site;
- The sacrificial coal layer will be removed and the area topsoiled and vegetated to ensure no erosion takes place; and
- The area must be monitored thereafter to ensue that vegetation is established.

3.4.2 Opencast pits/strips

The environmental objective of the pit is to make it as safe as possible for humans and animals at closure, to affect the required water control and to achieve the highest land capability possible.

- Infilling of the pit/strips will occur as mining progresses and subsequent spoils rehabilitation will also take place for the areas which can only be accessed at the end;
- Material will be replaced in the reverse order to which it has been removed;
- If a certain lithology could significantly affect water quality it should be buried below the final expected water table; and
- The areas that have been infilled will be shaped to reduce the likelihood of ponding occurring on surface and to blend in with the surrounding topography.

3.4.3 Infrastructure areas

- All portable infrastructure will be removed off the site;
- Structures that require demolishing such as the hard park area will be demolished to 1m below ground level for areas which cannot be used by a subsequent land user;
- The rubble will either be buried on site provided it will not have any detrimental impacts on water quality; and
- All areas will be shaped and topsoiled with 300mm of topsoil and vegetated.

3.4.4 Pollution control dams

- The pollution control dam will become evaporation dams (wilderness land) at and after closure. During decommissioning activities, dirty water will continue to be fed into it, but once the area has been fully rehabilitated and maintained for three years, run-off from these areas will be accepted to be clean and allowed to discharge. The pollution control dam will only then receive seepage from the dump and rainfall that falls directly into it;
- It will be covered by a layer of soil that will be able to support plant growth under a normal level of farm management; and
- All surface water, which will be considered to be clean water and meets the necessary catchment objectives after vegetation has established itself, will be diverted past the pollution control dam into the catchment.

3.4.5 Access roads

Access roads around the site should be ripped for all areas except those needed to access the facilities for inspection after closure. Wherever there are access roads that should be useable by the surface owner, these should be left.

3.4.6 Power line and electrical infrastructure

The environmental objective is to remove all infrastructure not required by future users of the property.

All onsite electrical reticulation infrastructure should be removed from site or, if the property of Northern Coal, should be sold and disposed of. The regional power line will be the property of Eskom and should remain on site for future use as it will serve the other customers around the area.

3.4.7 Post closure monitoring

Monitoring of possible decant from the pits will be required post closure as this may have a significant impact on surface water. For a detailed monitoring plan, refer to Section 15.

3.4.8 Air quality

The dust fallout stations should be maintained for a period of 5 years after closure or until a long term trend is established. If it is known that dust in excess of the baseline levels is occurring then the source of this dust will be established and suitable mitigation measures should be instituted.

3.4.9 Water monitoring

Surface and groundwater monitoring should continue for a period of at least 5 years after the cessation of production activities or until the pre mining models are verified and the impacts from the various facilities are understood. Monitoring will continue further if results indicate a lack of compliance with water quality objectives. These water monitoring points should be left open for future monitoring by authorities if required, with suitable access control.

3.4.10 Social aspect

The social impact of the mine closure should be managed for a period of 3 years after final closure to ensure that any plans and closure activities related to training of staff and resettling of staff have proved successful. Also the surface owners should be consulted with for a period of 3 years to ensure that they know how to maintain the various facilities which are remaining. The community development impact should be monitored for a period of 3 years after closure. A trust will be set up to fund community projects

3.5 CLOSURE COSTS

The closure cost assessment involves the quantification of mining and infrastructure components and applying rates to rehabilitate each component.

The environmental liability is described in monetary terms in order for a financial provision to be set-aside in a dedicated fund for closure and rehabilitation purposes.

Regulation 53 lists the following methods available to mines to make financial provision available:

- A financial guarantee;
- A cash deposit;
- An approved contribution; and
- Any other method deemed satisfactory by the directorate.

The financial provision will be made in the form of a Bank Guarantee, which will be submitted to the DM on request.

The calculation of the financial provision only takes in to account the disturbance expected after one year of mining. Thereafter, an annual closure cost assessment will be conducted to determine the financial provision.

The financial provision was calculated using the DM rates. . The costs calculated for the financial provision for the **first year of operation** is **R1,931,079.49.** In the first year the initial cut will be established and a number of strips will be established before rehabilitation of the initial cut is initiated. The closure cost calculation, therefore, has accounted for the rehabilitation of five strips as all other rehabilitation of the opencast area will take place during the operational phase and will form part of the operational costs.

It is recommended that the closure cost calculations be reviewed after the first year of mining and that updated rates are used to give an accurate costing of rehabilitation activities. The estimated fianl void can be seen on plan

Plan 25: Final Void

3.6 CALCULATION OF FINANCIAL PROVISION

Table 66: Financial provision calculation table

Northern Coal Weltevreden "Rules-base" assessment of the quantum for financial provision							
CALCULATION OF THE QUANTUM							
Mine:	Northern Coal Weltevreden						
No.:	**Description:**	**Unit:**	**A Quantity**	**B Master rate**	**C Multiplication factor**	**D Weighting factor 1**	**E=A*B*C*D Amount (Rands)**
			Step 4.5	**Step 4.3**	**Step 4.3**	**Step 4.4**	
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	m^3	0	6.82	1.00	1.10	R 0.00
2 (A)	Demolition of steel buildings & Structures	m^2	0.00	95.00	1.00	1.10	R 0.00
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	0.00	140.00	1.00	1.10	R 0.00
3	Rehabilitation of access roads	m^2	4800.00	17.00	1.00	1.10	R 89,760.00
4 (A)	Demolition & rehabilitation of electrified railway lines	m	0.00	165.00	1.00	1.10	R 0.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	0.00	90.00	1.00	1.10	R 0.00
5	Demolition of housing &/or administration facilities	m^2	0.00	190.00	1.00	1.10	R 0.00
6	Opencast rehabilitation including final voids & ramps	ha	4.00	99600.00	**0.52**	1.10	R 227,884.80
7	Sealing of shafts, adits & inclines	m^3	0.00	51.00	1.00	1.10	R 0.00
8 (A)	Rehabilitation of overburden & spoils	ha	2.00	66400.00	1.00	1.10	R 146,080.00
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	0.00	82700.00	1.00	1.10	R 0.00
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	0.00	240200.00	**0.55**	1.10	R 0.00
9	Rehabilitation of subsidised areas	ha	0.00	55600.00	1.00	1.10	R 0.00
10	General surface rehabilitation	ha	2.00	52600.00	1.00	1.10	R 115,720.00
11	River diversions	ha	0.00	52600.00	1.00	1.10	R 0.00
12	Fencing	m	3000.00	60.00	1.00	1.10	R 198,000.00
13	Water management	ha	10.00	20000.00	**1.00**	1.10	R 220,000.00
14	2 to 3 years of maintenance & aftercare	ha	10.00	7000.00	1.00	1.10	R 77,000.00
15 (A)	Specialist study	SUM	0.00	**1.00**	**1.00**	1.10	R 0.00
15 (B)	Specialist study	SUM	0.00	**0.00**	**0.00**	1.10	R 0.00
						Sub Total 1 (Sum of items 1 to 15 Above)	**R 1,074,444.80**
				Weighting factor 2 (step 4.4)			
1	Preliminary and General	12.5% of Subtotal 1		Change according to urban, peri-urban and remote		**1.05**	R 141,020.88
2	Administration & supervision costs	6.0% of Subtotal 1					R 64,466.69
3	Engineering drawings & specifications	2.0% of Subtotal 1					R 21,488.90
4	Engineering & procurement of specialist work	2.5% of Subtotal 1					R 26,861.12
5	Development of a closure plan						
6	Final groundwater modelling	2.5% of Subtotal 1					R 26,861.12
						Sub Total 3 (Subtotal 1 plus sum of management & administrative items, 1 to 6	**R 1,355,143.50**
7	Contingency					VAT (14%)	R 189,720.09
					(Subtotal 3 plus VAT)	**GRAND TOTAL**	**R 1,544,863.59**
8	Allowance for inflation						**R 386,215.90**
9	Updated Total						R 1,931,079.49

4 COMPLIANCE WITH SECTION 39(4)(A)(III) – CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT

"The applicant has the capacity, or has provided for the capacity, to rehabilitate and manage the negative impacts on the environment."

Northern Coal will put in place the sufficient management capacity in order to adequately manage and rehabilitate the environment. The following environmental personnel will be employed permanently by Northern Coal:

- Health, Safety and Environmental Coordinator; and
- Environmental Officer.

During rehabilitation independant consultants may be requested undertake specialised studies in order to evaluate preformance, pollution extent, success of rehabilitation and other services.

4.1 ANNUAL CASH FLOW FOR MITIGATION COSTS

An annual cash flow for costs associated with the mitigation of environmental impacts of the proposed project is provided in Table 67. Please note that the cash flow is only an approximation and that costs for standard practice, such as the construction of PCDs, have not been included.

Table 67: Annual cash flow for environmental mitigation costs[1]

Mitigation measure	Unit	Rate
Construction phase (6 months)		
Emergency spill response plan	Per annum	R 120,000
Dust suppression	Per annum	R 1,050,000
Aquatic biomonitoring	Per annum	R 60,000
Minimum annual cashflow required		**R 1,230,000**
Conservation architect	Once-off	R 90,000
Construction of noise berms	Once-off	R 75,000
Planting of trees / vegetation	Once-off	R 120,000
Once-off cashflow required		**R 285,000**
Sub-total		**R 1,515,000**
Operational phase (7 years)		
Emergency spill response plan	Per annum	R 120,000
Dust suppression	Per annum	R 1,050,000
Groundwater monitoring	Per annum	R 300,000
Air quality monitoring	Per annum	R 50,000

[1] This calculation does not take into account possible increases or decreases in annual costs due to inflation or deflation.

Mitigation measure	Unit	Rate
Aquatic biomonitoring	Per annum	R 60,000
Minimum annual cashflow required		**R 1,580,000**
Decommissioning and closure phase (1 year)		
Emergency spill response plan	Per annum	R 120,000
Dust suppression	Per annum	R 550,000
Alien invasive eradication	Per annum	R 300,000
Minimum annual cashflow required		**R 970,000**
Post-closure phase (Unknown - up to 5 years)		
Post-rehabilitation monitoring	Per annum	R 100,000
Alien invasive eradication	Per annum	R 100,000
Minimum annual cashflow required		**R 200,000**

5 CONCLUSION

This EIAR EMP was compiled in support of a mining right application for the Northern Coal Weltevreden Project. The aim of the EIA process and the related studies is to provide adequate information to the decision makers in order to make an informed decision on the way forward.

The necessary social and environmental studies were conducted in order assess the impacts on the physical, biological and social environments within the proposed mining area. The impacts that mining is expected to have on these different environments have been assessed using a detailed quantitative impact assessment methodology. Mitigation measures and monitoring programs were generated and are included to assist in minimising and avoiding the negative impacts and maximising the benefits of the proposed mining operation.

The average significance of the impacts that were identified during the construction, operational and decommissioning phases will be medium-low before mitigation. These potential impacts should be mitigated and managed during the life of mine in order to reduce the significance of the impacts. Impacts such as AMD, removal of the coal seam, increase in traffic and impacts on I&APs will still remain significant, despite mitigation measures.

Some of the more significant positive and negative impacts that are expected to result from the Weltevreden Project include the following:

- Alteration to topography from opencast pits and rehabilitation will have a negative impact on the topography of the site;
- Disturbance to the geological sequence and removal of coal. This is a permanent impact and mitigation will not be possible;
- Increase in erosion potential to soils from surface disturbance and vegetation removal. This could result in the loss of topsoil;

- Loss of the natural soil structure and soil properties from handling and contamination;
- Loss of the current agricultural land use and loss of high agricultural potential land;
- AMD could result in deterioration of surface and groundwater resources after closure;
- The establishment of the opencast may dewater the surrounding aquifers;
- The opencast areas will result in the destruction of habitats. A buffer zone will be required around the wetland areas and aquatic ecosystems to minimise/prevent impacts on them;
- Modification of hydrological processes will occur in areas where dewatering will take place; and
- Positive impacts are expected in terms of employment (limited), skills development, regional spending, and contribution to taxes, implementation of the Social and Labour Plan and the continuous supply of coal to Eskom to ensure electricity generation.

Taking into consideration the position of the proposed mining area within the catchment, it is recommended that direct impacts to the wetland areas be restricted to the proposed opencast areas only and mining activities adhere to the 1:100 year floodlines and described buffer zones. Additionally, the functioning of the wetland areas which will be lost and should be artificially created so as to ensure the survival of the remaining wetland areas and larger system as a whole, ensuring water quality provision and enhancement services continue.

In Mpumalanga 45% of the land is classified as high agricultural potential and the proposed Weltevreden Project will result in the loss of high potential agricultural land.

From the information gathered during the EIA process it can be concluded that the proposed mine’s overall impact on the natural environment will be of a medium significance. If all the mitigation measures, management and monitoring procedures recommended in this report are adhered to, the impacts will significantly be reduced.

DWA entrusts that this EIA EMP will provide adequate information for an informed decision to be made on the approval of the Mining Right.

6 UNDERTAKING

I,.., the undersigned and duly authorised thereto by .... have studied and understand the contents of this document in its entirety and hereby duly undertake to adhere to the conditions as set out therein.

Signed at ....on this.............day of..........................

Signature of applicant   Designation

DMR acceptance of the EMP for the Northern Coal Weltevreden project:

Signature of Regional Manager   Date

7 REFERENCES

ACOCKS, J.H.P, 1988. Veld types of South Africa. 3rd edn. *Memoirs of the Botanical Survey of South Africa* **57**: 1-147

ANHAEUSSER, C.R & M.G.C. WILSON (ed), 1998: *The Mineral Resources of South Africa.* Council for Geoscience.

BARNES K. N. (ed) 2000. The Eskom Red data Book of Birds of South Africa, Lesotho & Swaziland. Birdlife South Africa, Johannesburg

BEZEUIDENHOUDT, H.& BREDENKAMP, J.G. 1990, A reconnaissance survey of the vegetation of the dolomite region in the Potchefstroom-Ventersdorp-Randfontein area, South Africa. *Phytocoenologia* 18: 387-403

BRANCH, B. 2001. *Snakes and Other Reptiles of Southern Africa*. Struik Publishers, South Africa.

BRAUN-BLANQUET, J. 1964. Pflanzensociologie. 3 Aulf. Weien. Springer

BREDENKAMP, J.G. 1982. *'n Plantekologiese studie van die ManyeletinWildtuin*. D.Sc. thesis, University of Pretoria, Pretoria.

BROMILOW, C. 1995. *Problem Plants of South Africa.* Briza Publications, Pretoria.

CMSA (Chamber of Mines of South Africa) and CRA (Coaltech Research Association), 2007: *Guidelines for the rehabilitation of mined land.* Johannesburg: CMSA.

DICKENS, C.W.S., AND GRAHAM, P.M. (2002). The South African Scoring System (SASS), Version 5, Rapid bioassessment method for rivers. *African Journal of Aquatic Science*. Vol. 27 pp 1 – 10.

DRIVER, A., MAZE, K., LOMBARD A.T., NEL, J., ROUGET, M., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K. & STRAUSS, T. 2004. *South African National Spatial Biodiversity Assessment 2004: Summary Report.* South African National Biodiversity Institute, Pretoria.

DU PLESSIS, F. 2001. A phytosociological synthesis of Mopaneveld. M.Sc. thesis, University of Pretoria, Pretoria.).

DWAF (2002). Determining the conservation value of land in Mpumalanga. Mpumalanga Parks Board

DWAF (Department of Water Affairs and Forestry), 2003: A practical field procedure for the identification and delineation of wetlands and riparian areas. Pretoria: DWAF.

ELZINGA, R.J. 2000. Fundamentals of Entomology. Prentice Hall, Upper Saddle River, New Jersey.

EMAKHAZENI LOCAL MUNICIPALITY(ELM), 2006: *Environmental Management Framework (EMF)*. Strategic Environmental Focus (Pty) Ltd 4 3 Third Draft – 10 October 2007

EMAKHAZENI LOCAL MUNICIPALITY(ELM), 2007: *Integrated Development Plan 2006-2011*.

ESKOM, 2008: Eskom Holdings Limited Annual Report 2008.

FERRAR, A.A. & LOTTER, M.C. (2007). *Mpumalanga Biodiversity Conservation Plan Handbook*. Mpumalanga Tourism & Parks Agency, Nelspruit.

FRIEDMAN, Y. AND DALY, B. 2004 *Red Data Book of the Mammals of South Africa: A Conservation Assessment.* CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust. South Africa.

GROBBELAAR R. Usher B. Cruywagen L-M. De Necker E. Hodgson F.D.I. 2004. *Long-term Impact of Intermine Flow from Collieries in the Mpumalanga Coal Fields*. WRC Report no. 1056/1/2004.

HANNEKENS, S.M. 1996b. TURBOVEG – Software package for input, processing and presentation of phytosociological data. Users guide. University of Lancaster, Lancaster.

HENNING, S.F. & HENNING, G.A. 1989. *South African Red Data Book – Butterflies.* Sasolburg Litho, Vanderbijlpark.

HILL, M.O. 1979b. TWINSPAN. A Fortran program for arranging multivariate data in an ordered two-way table by classification of individuals and attributes. Ithaca, New York: Cornell University.

HILTON-TAYLOR, C. 1996. *Red Data List of Southern African Plants*. Strilitzia 4. Aurora Printers, Pretoria.

HODGSON F.D.I. LUCAS E. 2006. Interim Report on Mine Water Balances in Intermine Flow for Ingwe Collieries in Mpumalanga. Report no. 2006/06/FDIH.

HODGSON F.D.I. KRANZ R.M. 1998. Groundwater Quality Deterioration in the Olifants River Catchment above Loskop Dam with Specialised Investigations in the Witbank Dam Sub-Catchment. WRC Report no. 291/1/98.

JOHNSON, M.R., Anhaeusser, C.R. and Thomas, R.J. (Eds.) (2006) *The Geology of South Africa.* Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria.

KLEYNHANS, C.J. & LOUW, M.D. (2007). Module A: EcoClassification and EcoStatus determination in River EcoClassification: *Manual for EcoStatus Determination* (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report.

LÖTTER, M. 2007. Biodiversity status of the Mpumalanga Lakes District. Scientific Services. Mpumalanga Tourism & Parks Agency. Proceedings of the Mpumalanga Lakes District, Chrissiesmeer, 31 August 2007

LOW, A.B. & REBELO, A.G. 1996. *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs and Tourism, Pretoria.

MUCINA, L, RUTHERFORD, M.C. & POWRIE, L. 2006. Vegetation Map of South Africa, Lesotho & Swaziland. SANBI, Pretoria.

MUELLER-DOMBOIS, D. & ELLENBERG, H. 1974. Aims and methods of vegetation ecology. John Wiley & Sons, New York

NASAWC (Non-Affiliated Soil Analysis Working Committee), 1991: *Methods of soil analysis.* Pretoria: SSSSA

NEL, P.W.A, 2008. Geology and Coal Characteristics on Portion 15 and 16 of Weltevreden 381 JT. Northern Coal (Pty) Ltd.

NKANGLA DISTRICT MUNICIPALITY, 2006: Nkangla District State of the Environment Report

PASSMORE N.I., & CARRUTHERS, V.C. 1995. *South African Frogs: A complete Guide.* Southern Book Publishers, Witwatersrand University Press, South Africa

PHAMPHE, A.R. 2003. Phytosociology of Transkei grasslands. M.Sc. thesis, University of Pretoria, Pretoria).

POOLEY, E.S. 1998. *A Field Guide to Wildflowers Kwazulu-Natal and the eastern region.*Natal Flora Publishers Trust: Durban, South Africa.

PICKER, M., GRIFFITHS, C & WEAVING, A. 2002. *Field Guide to Insects of South Africa.* Struik Publishers, Cape Town.

PROFESSIONAL GRACE SOLUTIONS (PGS) Heritage Unit: (2008) Archaeological Impact Assessment, Northern Coal Portion 15 and 16 of the farm Weltevreden 381 JT, Belfast, Mpumalanga, Version 1.0, 22 July 2008

RIVER HEALTH PROGRAMME (RHP) (2001) *State of the rivers report: Crocodile, Sabie-Sand and Olifants River systems*. Water Research Commission Report: TT147/01, WRC, Pretoria.

ROBERTS 2003. Roberts' Multimedia Birds of Southern Africa.

SCWG (Soil Classification Working Group), 1991: *Soil classification. A taxonomic system for South Africa.* Pretoria: Institute for Soil, Climate and Water

SKINNER J.D. & CHIMIMBA C.T. 2005. *The Mammals of the Southern African Subregion (3rd Ed.).* Cambridge University Press, Cape Town.

SOREGAROLI, B.A. and LAWRENCE, R.W. (1998). Update on Waste Characterization Studies, Proc. Mine Design, Operations and Closure Conference, Polson, Montana

TICHÝ, L. 2002. JUICE software for vegetation classification. *Journal of Vegetation Science* 13(3): 451–453.

VAN OUTSHOORN, F. 1999. *Guide to grasses of Southern Africa.* Briza Publications, Pretoria, South Africa.

VERMEULEN P.D. HODGSON F.D.I. 2005. *Recharge in South African Underground Collieries*. Biennial Groundwater Conference, Pretoria.